

A MANUAL OF
CLAY-MODELLING

HERMIONE UNWIN

SCU

MC

CLAY-MODELLING

The Society of Arts & Crafts
A MANUAL
OF
CLAY - MODELLING

FOR TEACHERS AND SCHOLARS

BY

MARY LOUISA HERMIONE UNWIN

EXAMINER IN CLAY-MODELLING TO THE EDUCATIONAL HANDWORK UNION

WITH SIXTY-SIX ILLUSTRATIONS

AND

A PREFACE

BY

T. G. ROOPER, M.A.

BALLIOL COLLEGE, OXFORD

LONDON
LONGMANS, GREEN, AND CO.
AND NEW YORK
1895

All rights reserved

PREFACE

Die Kunst, O Mensch, hast du allein

THERE are many signs that Art is to be made in future a part of general education ; and, as is often the case with a movement which is widespread, the root of it is not simple, but divided into several ramifications. Many educational principles which are accepted independently of each other in the first instance, when carried out in practice are found to lead to the introduction of artistic training in ordinary school-work.

Of primary importance is Froebel's principle, that the constructive power of children, which was long trained only by chance, must in future be systematically attended to, so that they may be accustomed not only to hear and receive information, but in some definite way to exercise their faculties for shaping and making. In other words, the child must learn to express himself with his hands by making objects out of varied material.

Then, again, as a basis for Technical Education, the importance of using and improving the sense of touch, and the kindred sense of sight, is daily more and more insisted upon by those who have to deal with the rudiments of this kind of instruction.

No one can study the principles of the right bringing-up of children without becoming aware of the necessity for

Manual Training on moral and hygienic grounds. It is important, however, to remember that educational Handwork is not a mere question of muscular development. The aim of all work at school should be moral and intellectual improvement, and Handwork should form no exception to this rule. In this kind of instruction, if it is appropriate to child-life, and not a premature industrial training, the brain is reached through the muscle, and muscular activity is employed to expand the intellect.

No sooner are we led on varied grounds to see the need of teaching children to use their hands in construction, than we feel the advantage of teaching them to make things as beautiful as possible; and as soon as the desire to make passes into the desire to make beautifully, we pass from mere industry to at least a rudimentary love of Art. That 'industry without Art is brutality,' is a fact which has never been better illustrated than by Lord Beaconsfield in his description of the Black-country locksmith, whose workshop, with its apprentices, is powerfully depicted in 'Sybil.'

The truth is that to-day statesmen, poets, preachers, philosophers, economists, and friends of education, are all at one in emphasising the need of a widespread training in Art.

If, then, Art is to be taught in elementary schools, what form of it is most suitable for the purpose? I believe none is of more universal application or more fundamental than Clay-Modelling. As a foundation for artistic training, Modelling is superior to Drawing; for objects which are drawn must be represented as they appear, whereas objects that are modelled must be treated as a whole, just as they are in Nature. The expression of an Object with pencil or brush is a reduction of what is handled in space of three dimensions to the picture-plane, which is space of two dimensions. In Modelling, the student deals with the round, with mass, and with bodies as they are fully known to us. Modelling is an

older art than Painting, and the best authorities insist upon it that the studio of the sculptor is the best preparation for the painter and the draughtsman.

The first rudiments of the Artist's skill are Perception and Manual Dexterity. These can be divided in thought, but not in practice. In trying to express what we see we learn to perceive more accurately.

The child-artist in his first school must learn to produce in clay the perceptions which he has acquired of natural objects. There is a true analogy between language regarded as the raw material of orators, poets and writers, and clay, which is the raw material of the artist. As artists in words must acquire command over language, so the modeller must learn to express in clay the ideas which he has derived from an accurate study of some natural object. He must learn, if I may venture on the phrase, 'to talk in clay.' This he can only do when his power of perception of natural objects is equalled by his manual dexterity. He must, in addition, learn the rules of his art, which have been evolved in the course of many generations, without appearing to be fettered and trammelled by their limitations. For school purposes, Modelling has the advantage over Carving. The plastic clay offers but little resistance to the hand of the modeller, and readily takes any form which it may be his will to produce. Wood and stone offer a stubborn resistance to the expression of the mental conception in these materials.

The sculptor has to accomplish the presentation of his ideal by hewing away that part of the material which surrounds his design while yet in the solid block. The modeller can build up his conception by a process of addition, and he can improve his mental conception as he works on the clay. It is easier for the modeller to correct his mental image, when the model of it is seen to be false, than for the carver, whose mistake remains unalterable.

The first training of the young artist is perception of Nature. In imitating an object he learns its nature. By words his teacher will explain to him the structure of the object and the meaning of characteristic points in it. By words the teacher may explain to him the beauty of form which may be observed in the natural object. By words, also, the child may be helped to see this beauty. For the perception of beauty in an object is an act of reason, in so far as it involves perception of unity in diversity, and tracing continuity where it is not apparent to a mere animal gaze. The child, however, can only really seize and fully apprehend the form and beauty of the object by an effort of thought and constructive imagination, such as is needed to make a model.

The commencement of the study of an object must needs be a process of analysis and dissection. How can unity be better restored to the fragments thus produced than by modelling the object as a whole?

Language, it has been well said, is a liberation of the understanding; and so, also, the modelling of a beautiful form is a liberation, or setting free, of the imagination.

It is of great consequence that the teacher should resort in the beginning to Nature itself, and not set the young child to copy beautiful forms which have been abstracted by artists from natural objects in past time. It is not ready-made Art which the child needs, but Art in the making. The child must learn to see with his own eyes at once the riches and the simplicity of Nature. He must perceive the beauty of an object, and in modelling it build up the beauty which he has comprehended.

Of course I am not advocating a crude naturalism. A work of Art is the work of a true artist, so far as it presents Nature; but yet the spectator must always be conscious that it is a work of art, and not Nature. An attempt to present an object by mere accumulation of details, slavishly imitated,

and added together piecemeal, does not produce a work of art, even in a rudimentary way. Although the details must be exactly studied, and the meaning of each understood separately, the object must be rendered as a whole, and some details must be merged in the general mass for the sake of due effect in light and shade.

It will be the teachers' pleasure to show their pupils how beauty in natural objects is, so to say, scattered throughout them, and that it is the eye of the artist which condenses or concentrates it, and his hand which presents the beauty of Nature in a readily visible form.

All the magic of beauty which may bewitch the mind of man, and raise it far above the monotonous round of life's daily drudgery, may be drawn out of a few objects such as have been selected by the author of this little book.

I have observed that children take the greatest interest in the occupation, both while modelling these objects, and afterwards, when the models are completed.

It is fortunate for human progress that much that is most beautiful is most common and most cheap, demanding for its appropriation only some effort of attention and will. In Art, at any rate, there needs no costly apparatus to elevate the mind. Although few can become artists, all can become lovers of art, and learn to look on the artist's productions with sympathetic acknowledgment of his power. Many must apply themselves to art before one man of real genius can arise to adorn it. Apart, however, from all high success, the mere conscientious pursuit of an art enables the student to appreciate, as he could not otherwise do, the highest kind of work in the art which he studies, and—what is of great consequence—to know good work from bad. 'In the temple of Art, many who can never stand on the pinnacle may find a safe corner near the ground,' and education of which art forms a part will make the lives of all better and happier; for through a right study of Art the

child may find a new joy in his home and usual surroundings. After a very little study of Art, things which seemed common and uninteresting become invested with rare charms and delights, which transcend all previous knowledge and belief, and raise the student to a new and purer atmosphere of life and thought.

While dwelling on the formative value of Clay-Modelling in education, I must not omit briefly to call attention to its utilitarian advantages. Clay-Modelling may be employed to illustrate and support many branches of study. It may help to make more intelligible a geographical knowledge of the surface of the earth, and render many events in history, such as battle-fields and sieges, more interesting to the children. In Science and Natural History its applications are endless; as an example, I would mention the modelling of a bean during germination at short, successive intervals, with the object of impressing on the mind the process of development. In the study of Horticulture, a series of models of a particular variety of the carrot or potato, when the plant has been subjected to varying treatment, would be of considerable practical value. Numerous instances will occur to every teacher, and therefore it is unnecessary to dwell at greater length on the utility of Clay-Modelling.

T. G. ROOPER.

CONTENTS



| | PAGE |
|---|------|
| PREFACE | v |
| INTRODUCTION | 1 |
| 1. AIM OF MANUAL | 1 |
| 2. ARTISTIC VALUE OF CLAY-MODELLING | 1 |
| 3. TEACHING OF CLAY-MODELLING SHOULD PRECEDE THAT OF DRAWING | 2 |
| 4. REASONS FOR ITS INTRODUCTION INTO SCHOOLS | 3 |
| 5. POWERS DEVELOPED BY CLAY-MODELLING | 3 |
| 6. SUITABLE AND UNSUITABLE MODELS | 3 |
| 7. CHOICE OF METHODS IN WORKING MODELS | 5 |
| 8. OBJECTS, AND NOT COPIES, TO BE USED AS MODELS | 6 |
| 9. NUMBER OF MODELS REQUIRED FOR A CLASS | 6 |
| 10. OBJECT-LESSON FOR CHILDREN | 6 |
| 11. NUMBER OF PUPILS IN A CLASS | 6 |
| 12. SOME MODELS TO BE ENLARGED | 6 |
| 13. POSITION OF MODEL | 7 |
| 14. POINTS TO BE OBSERVED IN WORKING | 7 |
| 15. REASONS FOR USING A SLAB | 7 |
| 16. ORDER OF MODELS IN COURSE | 8 |
| 17. ARRANGEMENT OF COURSE FOR A CLASS OF CHILDREN | 8 |
| 18. METHOD OF WORKING, AND DESCRIPTION OF TOOLS | 8 |

| | PAGE |
|--|-------|
| 19. USE OF ARMATURE | 11 |
| 20. DESCRIPTION OF MODELLING-BOARD | 11 |
| 21. KIND OF CLAY TO BE USED | 12 |
| 22. LEVEL TABLE TO BE USED | 12 |
| 23. ORDER OF POINTS TO BE OBSERVED IN WORKING-MODELS | 12 |
| 24. DEFINITION OF 'MASS' | 12 |
| 25. MODELS TO BE BUILT UP, NOT CUT OUT | 12 |
| 26. HOLLOW MODELS | 14 |
| 27. CARE OF THE CLAY | 14 |
| 28. PRESERVATION OF WORK | 14 |
| 29. OBJECTIONS TAKEN TO CLAY-MODELLING | 15 |
| LIST OF MODELS IN THE COURSE | 16 |
| WORK FOR INFANTS | 17 |
| ADVANCED WORK | 18 |
| ADDITIONAL INSTRUCTIONS TO THE TEACHER | 19 |
| DIRECTIONS FOR MAKING A SLAB | 20 |
| GENERAL DIRECTIONS APPLYING TO ALL MODELS | 22 |
| DETAILED DIRECTIONS FOR WORKING THE MODELS | 23-84 |
| GENERAL DIRECTIONS FOR ADVANCED WORK | 85 |
| INDEX | 87 |

A MANUAL OF CLAY-MODELLING

INTRODUCTION

1. This Manual of Clay-Modelling and the Course of Lessons which it sets forth are intended to serve both for Classes of Teachers and of Scholars, and, excepting where the contrary is specified (as in Sections 10, 12, 17, 31, and 34), the directions may be followed as they stand in either Class. The principles of the method of working are, of course, the same in both cases, but older pupils will make more rapid progress, and go through the whole Course in less than half the time required by a Class of Children.

2. The practice of Clay-Modelling, when it is taught in the right way, develops the artistic powers more than any other form of Educational Handwork. Hitherto the artistic side of a child's nature has been much neglected in the ordinary school curriculum, and what art teaching has been given has been of a kind likely to crush rather than develop all artistic instinct, unless a child has been endowed with much more than the usual amount. In the Modelling-lesson there should be as little of the routine of ordinary lessons

as is possible, so that it may be regarded as a recreation and a pleasure, and that each child may be free to do the work by the method he likes best, and to realise the delight of exercising his creative power—a feeling which is strong in all children. The better he succeeds, the further will his imagination be stimulated. A child is always ready to receive new impressions, and often sees things with a clearer eye than his elders, not having already made up his mind how he thinks they ought to appear. Thus there is sometimes a freshness about his work which is wanting in that of older people. He will often perceive and seize the essential characteristics of an object, probably without realising how he does so; and it should be our aim to develop and strengthen this power before it becomes dulled, that it may not be an accident that the model of the leaf looks leaf-like, or the model of the shell, shell-like. The earlier, therefore, that we begin, the better, and the more hope will there be of achieving good results.

3. The teaching of Clay-Modelling should precede, not follow, that of Drawing, but if they are studied together by the same methods they will mutually aid each other. The same principles apply to both arts, but Drawing is a more abstract art than Clay-Modelling. In Drawing there are only two dimensions—length and breadth—to work with, instead of three, and therefore in Drawing the laws of foreshortening and perspective have to be understood, which at the outset present great difficulties to a child. But in Clay-Modelling the object is copied exactly as it is, in three dimensions—length, breadth, and height—and has to be considered from all sides; so that in modelling an object more is learnt than in simply drawing it, when only one point of view is studied.

In order that the two arts may help each other, the objects which a child has already modelled may be given as

the first exercises in Drawing, and he should be taught to shade them in a simple way.

4. But it is not only for the end itself, but for the means by which this end is attained, that Clay-Modelling is specially valuable as a method of mental and manual training. It is a subject which appeals strongly to children of all ages, and it may be begun in the lowest classes, and carried on right through the school without a break, the work being continuous throughout. Many good habits of mind which may be more easily developed while a child is young are induced by its practice.

5. The principal powers which the practice of Clay-Modelling develops are :—

- (1.) Observation.
- (2.) Accuracy, especially in the perception of form.
- (3.) Dexterity of hand.
- (4.) Sense of form and proportion.
- (5.) Greater power in drawing.
- (6.) Love and appreciation of the beautiful in form.
- (7.) Enjoyment of the creative power in oneself.
- (8.) Perseverance and patience.
- (9.) Concentration of the attention.

6. The objects which are most suitable as models for Clay-Modelling, and which will help most surely to develop these powers, are those which are simple in form, and yet have some element of grace or beauty in them, by reason of their variety of lines or graceful curves.

All objects given as models should be such that in reproducing them they must of necessity be moulded by the fingers. Those which can be turned out by a lathe, or a potter's wheel, or by any machine, better and more accurately than by a skilful hand are, for that reason, not suitable.

Geometrical forms should be avoided : they are uninteresting, and give only a mechanical training, besides lacking beauty and the element of art. The difficulty of making two sides of an object exactly alike is great, and does not occur in copying natural objects, of which the sides never quite match each other, however symmetrical they may appear. The exercise of balancing the masses rightly in copying the natural object is far more valuable. Geometrical forms possess no variety of lines to enforce observation, no beautiful curves to be enjoyed. They have only straight lines, sharp angles, or symmetrical curves, which can be turned out much better by machinery than by hand.

There still remains the choice between a course of Natural Objects and of Conventional Models, both being suitable for reproduction in clay. But here the tastes of the students themselves, especially of children, pronounce very strongly in favour of Natural Objects. Far more interest is aroused in a child by an object of which he already has some knowledge, and which has a connection with his everyday life, than by a comparative abstraction, which is strange to him. The child will try with greater zest to copy an object which he knows, than something which does not convey a clear idea to his mind. This interest will add much to the enjoyment of the work, and should be fostered by giving at first familiar objects as models, and then proceeding to the less known ; although it will be found that there are few models in the following Course with which children are unacquainted.

To begin with conventionalised forms is to try and teach a child by means which are altogether beyond his ken—to use the abstract instead of the concrete ; though it is only of the latter that he has any knowledge. The conventionalised form is merely an opinion, artistic or otherwise, about the natural form, which is a fact. Therefore, to properly understand the former we must first study the latter. A child is unable to comprehend why the one should differ from the

other, and if he succeeds in recognising in the conventional form something which he knows, he will probably mistake that for the object as it is in Nature. That is, he mistakes an opinion, about which ideas may legitimately differ, for a fact. It is a matter of education to appreciate conventionalised form, and that education should begin by studying Nature herself. Later, of course, in an artistic training, the two must necessarily be studied together.

It has been urged in favour of conventional types that they can always be done 'in relief'—that is, projecting from a background—and that they are, therefore, better adapted for Clay-Modelling than objects which have to be modelled 'in the round,' because these latter are generally held in the hand while being worked, a method which, although it may seem to some easier for children, is against all the principles of the art. Objects modelled 'in the round,' unlike those modelled 'in relief,' are unattached to any background, and open on all sides except at the point which rests on the slab. The need, however, for holding the clay model in the hand is easily set aside by using the little armature described in Section 19, which, being buried in the model, supports it, and makes it perfectly easy to work.

7. Although in this Manual accurate directions are given for the working of each model, it is not necessary that these should always be followed exactly, so long as the general principles of working laid down are adhered to. The end to be striven for is to obtain a lifelike representation of the object, not a copy that is merely slavishly accurate, with all the life smoothed and finished out of it. Finish itself is only of secondary importance compared with attaining the character of the model. We should be able to forget in looking at the copy that it is made of clay, so real should it appear.

A child who has any natural aptitude for Clay-Modelling may succeed better by doing the work in his own way, and

not exactly according to the directions given. Originality of treatment, whether it follows the lines laid down in the directions or not, should be carefully encouraged and fostered, and by no means repressed.

8. The objects themselves must be given as models, and not copies or imitations of them, however good these may be, because in working from a copy we are looking through other people's eyes, and therefore have not to use our own to the same extent. Thus a great part of the training is missed.

9. A model should be provided for every student, or at least one to every two students, as otherwise accuracy of work is impossible. They should be able to examine the model closely ; and it is of great assistance to pass the thumb over it, in order to feel the actual shape of the surface.

10. For Children, an object-lesson treating of the shape and general appearance of the object should be given before the modelling is attempted. This is specially necessary in the earlier lessons.

11. Clay-Modelling cannot be properly taught to a class of more than twenty pupils. With a larger number it is not possible for a teacher to give the individual attention required.

For Children, the lesson may occupy about an hour, and the model should be finished in that time.

12. The elder pupils should be taught to enlarge objects which are very small, such as a cockle-shell ; while those which are large, like a loaf, may be decreased in size, thus making a variation of exercise. This, however, should not be expected of very young children.

13. The object should be placed in a natural position, and copied as it stands. If it is propped up by any means to keep it in place, and these means are not shown in the copy, the position is unnatural.

14. In modelling an object careful regard must be had, not only to its form and the shape of its various parts, but to the broad effect of light and shade, and of the individual shadows. It is one of the tests of good work that the shadows of the copy correspond with those of the model. To this end the object must always be in the same position as the copy. For instance, when turning the copy to work another side, the object must always be turned in the same way. The light, if possible, should only come from one side, so that the light and shade may be clearly defined; and the copy should not be brought up close to the eyes, but kept at a distance.

15. All models, except those specified below, should be done on a slab of clay, which the pupil must first make, and which represents the table or board on which the object rests. We cannot properly consider an object except in relation to its surroundings—it cannot hang in mid-air; and we must therefore show what these surroundings are.

Those models which do not require to be made with a slab are those only which might be actually used for the purpose for which they are obviously intended, such as a plant-pot, a pin tray, or a dish. Those which are merely representations of natural or other objects, such as an apple, or a boot, or a loaf, should always be worked on a slab. (See fig. f.)

It may be objected that to make a slab for every model occupies too much time. It is, however, a very simple operation, and as facility in work is gained it can be done

very quickly, and should not occupy more than five minutes.

16. The order in which the models in this Course are arranged is not intended to be followed absolutely, but they are placed generally in order of difficulty, the easier ones at the beginning. Due variety of form should be observed in the order in which they are given as lessons, and not too many of the same shape taken in succession. Nor is it necessary that every model in the list should be worked. Some of them are only to be obtained at certain times of the year, and must, of course, be omitted when they are out of season. Others may have to be left out, as in some places they are difficult to procure.

17. For a Class of Children a selection should be made of the most interesting models, and those which will prove most interesting to children are not necessarily the easiest. Three, or sometimes four, lessons may have to be given on each object, but care must be taken that the children do not become wearied by having the same model too often. It is best to interpose a new one, and then return later to the other. They may sometimes be asked to work from memory an object that they have already made, or be told to make some familiar thing which they have not as yet modelled.

18. In working the models the thumb and forefinger of either hand must be used as far as is possible—not the tip, but the ball of the finger or thumb; and the clay should be put on in such a way as to show the form of the surface it is desired to make. Thus, in doing a round surface we should give the thumb a circular motion; and for a flat surface it should have a straight motion. Where the thumb or forefinger cannot be used, wooden tools must be employed; and these should be curved, and not straight from end to

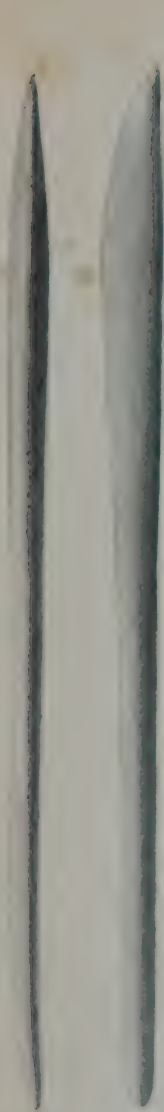


FIG. A

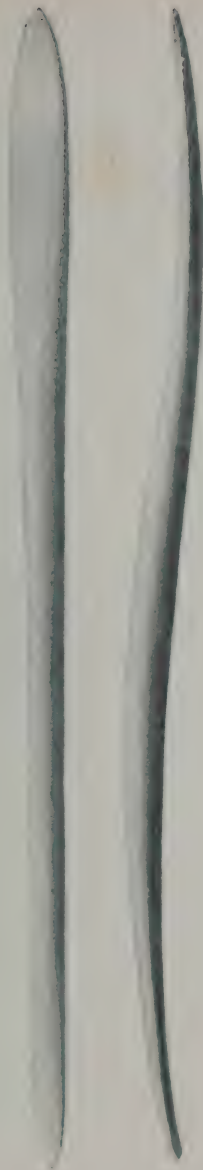


FIG. B

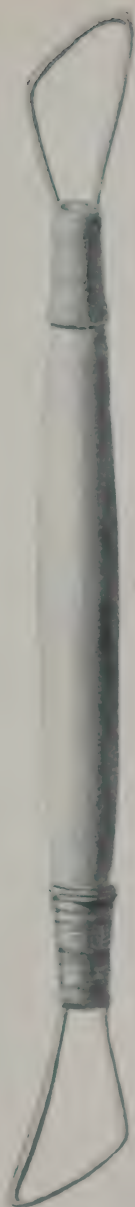


FIG. C

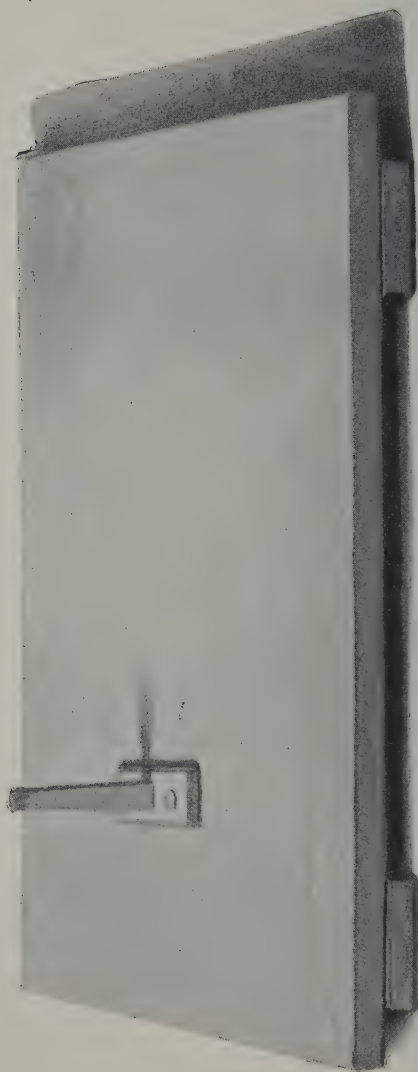


FIG. D

end, as are many of the tools made. The fewer the tools and the less they are used, the better. Two useful shapes are illustrated (figs. A, B). The smaller one is suitable for young children, for whom the other may be too large. Tools must not be held like a pencil, but grasped by all the fingers. A mirette, or rod with a wire loop (fig. C) at one or both ends, will be found very useful, especially for those models which require hollowing out, like the Sabot (Model No. 36). The fingers and tools must be constantly wiped on a damp sponge to keep them clean and free from clay, otherwise the dry clay off the fingers is worked into the model and the surface spoilt.

19. The clay model must not be held in the hand after the first general shape is obtained, but fixed on to an armature (fig. D), or iron upright, $1\frac{3}{4}$ inches high, screwed on to the modelling-board. It is against all the principles of the art for the student to hold the clay model in his hand while he is working on it. By doing so the work which has been already done is constantly being spoilt, and has to be commenced again, the model is pressed out of shape, the clay is dried by too much handling, and, moreover, the use of one hand is lost.

It is only in the case of the simpler rounded forms, like an orange, when the general shape can be rounded in the hands, that the model should be made at the commencement apart from the armature. In other cases it should be built up directly on the slab round the armature; but where the model does not need support, as in flat objects, like leaves, it should be simply worked on the slab without the armature.

20. The modelling-board (fig. E) should be not less than 9 inches by 11 inches in area, and should either have two wooden bars screwed on to the bottom, across the grain of

the wood, to prevent warping, or else have a piece of wood mortised on each end, like a drawing-board.

The armature must be fixed towards one end of the board (fig. D), to allow room for working those models which do not require it.

21. Terra-cotta clay is the best material for the work. The red clay has the advantage of pleasant colour, and it is also, if properly prepared, smooth and free from grit.

22. When possible the pupils should work on a level table, not on a sloping desk. They may be allowed to stand if they like.

23. The method to be followed in working the models is to proceed from the general to the particular, getting first the general shape or mass of the object, noting its proportions, character, and light and shade. Until this is fairly correct it is of no use to go further. Then the details may be put in, the most noticeable first, and lastly the minor ones.

It is better to put in the details of the upper part of the model first, and then those of the lower part. If the latter are done first, the work may be lost and have to be done again, as the clay may be pressed down on to the slab in working the top.

24. The word 'mass' is here used in its technical sense, to denote the whole shape, or large divisions, of an object, considered without the details. It does not refer specially to size, and may be applied equally to a cockle-shell or a mountain. When an object is much cut up by the details, the masses may be more easily perceived with half-closed eyes.

25. The mass should be built up of rather stiff clay, so

that a solid foundation is made ; but the modelling of the form must be done by putting on pieces of softer clay. For this reason the model at first should be made smaller rather

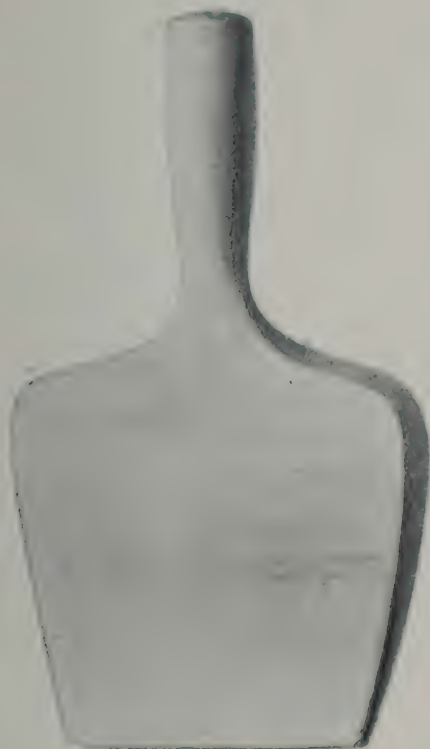


FIG. E

than larger than the object, to allow for the increase of size caused by putting on more clay. The model must not be cut or carved out of a larger mass, as if one were working

in wood or stone, in which arts the principles of working are contrary to those of Modelling.

26. In the case of hollow models (Models Nos. 11, 12, 21, 29, 43, 48, 52, 58, 59) soft clay must be used, and the fingers kept moist with the sponge, or the clay will crack. These models should not be made less than $\frac{1}{8}$ inch in thickness.

27. The care of the clay is very important, as, unless it is in proper condition, good work cannot be done. It must not all be of the same consistency, but the softest should not adhere to the finger when it is touched, and the stiffer must not be so dry as to crack with a little handling. The best way to keep it is in a zinc-lined box with a lid; but, failing this, it may be kept in a pail covered with wet woollen cloths, with a piece of mackintosh over the top. After the lesson is finished the clay used should be broken up and sprinkled with water, more or less according to its dryness; but water should never be allowed to stand in the box.

If the clay is too soft, it must be kneaded in the hands until the right consistency is obtained; and if it is too hard the same method should be followed, using water until it is quite smooth and free from lumps.

A small wooden scoop (fig. E) will be found useful for getting the clay out of the box.

28. When it is desired to preserve any piece of work, its slab should be detached from the board with a piece of thread or wire, and the model allowed to dry a little before it is lifted off the armature. After it is thoroughly dry it may be fired in a brick-kiln or baked in an ordinary oven, which should be cool when the models are put in. They will, however, last well when simply allowed to dry, if they are carefully treated.

29. It has been charged against Clay-Modelling that it is liable to spread infectious diseases in schools. No authentic case of such an occurrence has been found, and infection is far less likely to arise from clay than from books or from contact of clothes. It must be insisted on that the children come to the lesson with clean hands, and a child having anything the matter with its hands should not be allowed to touch the clay; or, if this is permitted, the clay thus used should not be mixed with the rest, but thrown away. If, however, stronger measures are desired, the clay may be sprinkled with Sanitas disinfectant instead of water, and then well kneaded up, so that the Sanitas is thoroughly incorporated with every part.

Clay has been known to develop a disagreeable odour, which has generally arisen from its having been put into a box which was not clean. No box which has contained any perishable material, such as butter, should ever be used. Clay is not an expensive material, and on its developing objectionable qualities should be at once thrown away; but if due care is taken this will not occur.

LIST OF MODELS

- | | |
|----------------------------|---------------------------|
| 1. Orange | 31. Pair of Mussel Shells |
| 2. Apple | 32. Poppy Capsule |
| 3. Plum | 33. Windsor Bean |
| 4. Pear | 34. Pork Pie |
| 5. Piece of Broken Stone | 35. Trinket Tray |
| 6. Lemon | 36. Sabot or Clog |
| 7. Pea Pod | 37. Mushroom |
| 8. Acorn | 38. Mussel Shells (con- |
| 9. Laurel Leaf | cave) |
| 10. Tomato | 39. Oak Leaf |
| 11. Saucer | 40. Tin Loaf |
| 12. Plant Pot | 41. Tam-o'-Shanter |
| 13. Onion | 42. Child's Shoe |
| 14. Potato | 43. Pin Tray |
| 15. Broad Bean | 44. Oyster Shell |
| 16. Chestnut | 45. Canoe |
| 17. Poplar Leaf | 46. Sycamore Leaf |
| 18. Carrot | 47. Cottage Loaf |
| 19. Cockle Shell | 48. Heart-shaped Dish |
| 20. Egg | 49. Cowrie Shell |
| 21. Bon-bon Dish | 50. Child's Boot |
| 22. Walnut | 51. Poppy Head |
| 23. Pomegranate | 52. Sugar Bowl |
| 24. Banana | 53. Plane Tree Leaf |
| 25. Cockle Shell (concave) | 54. Broad Bean (open) |
| 26. Almond Nut | 55. Snail Shell |
| 27. Ivy Leaf | 56. Boat |
| 28. Jerusalem Artichoke | 57. Pine Cone |
| 29. Octagonal Cigar-ash | 58. Trefoil-shaped Saucer |
| Tray | 59. " Cup |
| 30. Brazil Nut | 60. Whelk Shell |

WORK FOR INFANTS

The Course set forth in this Manual is suitable for children of six or seven years of age and upwards, and in some cases for younger children. But for Infants of three or four years Clay-Modelling at first can only be play with a method in it. As far as possible, the same principles should be followed as with older pupils, and a model provided for each child, that opportunities for comparison may be afforded, even in the earliest lessons.

It is not advisable to trouble children of that age to make a slab. They will, therefore, unlike older pupils, have to be allowed to hold the clay model which they are making in their hands, as the use of an armature necessitates a slab. It is a great advantage to young children to learn to handle the clay, and to become accustomed to using it. They will be found greatly to enjoy its mere manipulation.

They may begin with the simplest objects, such as beads, round or flat, of different sizes; cherries with string or wicker stalks. The letters of the alphabet, or figures, may be made of strings of clay rolled out between the hand and board to $\frac{1}{4}$ inch thickness, or less. This is of service to the children in impressing the shape of the letters on their minds. A sausage, or cigar; a small saucer, or a basket, made in the same way as Model No. 11; a bun, or an open pea-pod with loose peas in it made separately; a pat of butter, or a cottage loaf, are also suitable.

A bird's-nest is often considered an appropriate model for Infants, but is really far too difficult. Being composed of various materials, such as moss, hay, or feathers, its texture renders it unsuitable for reproduction in clay. It is impossible for a child to make it correctly and with truth. If he likes to make one on his own account, in the best way he is able, it is another matter.

ADVANCED WORK

For the work of advanced pupils, or for the higher classes in schools, more difficult subjects may be attempted. Those in the following list will be found suitable for studies :—

Sprays of the leaves of ivy, beech, oak, hazel (with or without nuts), hop, or rose.

Small branches of apple, pear, or plum, with the fruit attached.

A frond of hart's-tongue fern.

Sprays of the following flowers, with their leaves :—single dahlia, poppy, wild rose, convolvulus, clematis, iris, arum, tulip, nasturtium, daffodil.

A bow of ribbon, or a worn kid-glove, or a boy's cap.

All those above must be worked laid on a slab in relief, and should be copied from the object itself, as in the elementary course, and not from casts or other copies.

The following casts may also be used :—

Casts of parts of the human features, such as the nose, eye, mouth, or ear.

Casts of animals' heads, or the human profile ; or masks of the human head taken from life or after death.

Casts of boldly designed ornament are very suitable, but difficult to procure, as most of those made are too full of detail or fine work to be adapted for modelling.

*ADDITIONAL INSTRUCTIONS TO
THE TEACHER*

Each pupil (both Teachers and Children) must be provided with a board having an armature fixed upon it (fig. 19), a sponge, a tool, sufficient clay, and a model.

For a Class of Children, the Teacher himself will also require all these materials, and he may work the model in front of the Class, the pupils following his directions. He should also make drawings on the blackboard to explain any points which will elucidate the lesson.

Neatness in working should be enforced, and the pupils must not be allowed to scatter little pieces of clay about the modelling-board and desk. The clay which forms the supply for use should all be kept in one lump, and thus untidiness avoided. Strips of American cloth or newspaper may be spread on the desks to prevent their being soiled. The children should be encouraged to bring aprons or pinafores with them for the modelling-lesson. The training thus given in cleanliness and neatness in work is valuable.

Before beginning the model a square or oblong slab of clay must be made on the modelling-board. It will surround the armature, or not, according to the model (Section 19). Its shape and size depend on the model, which it must be large enough to hold with a margin all round. Small objects which have to be made on the armature, like a chestnut, require a thick slab, so that the armature does not show through the top of the model, which must never happen. The slab must always be placed so that its edges are parallel with those of the board.

Children may be allowed to smooth the slab and cut it square with a steel knitting-needle, that they may do it more quickly.

DIRECTIONS FOR WORKING THE MODELS

A SLAB OF CLAY

(FIG. F)

METHOD No. 1

1. Press pieces of stiff clay together on the board round the armature with the thumb, making the shape desired for the model. Be careful to give the slab the appearance of having right-angled corners from the first.

2. Make the slab about $\frac{3}{4}$ inch thick all over, or more if necessary for the model.

3. Smooth the top with the thumb, first in one direction, and then in the other.

4. Scrape off the uneven parts with the tool, and fill in any depressions with more clay.

5. Cut the sides straight with the tool, making them parallel with the edges of the board.

6. Smooth with the wet forefinger.

METHOD No. 2 (*for Children*)

1. Press pieces of stiff clay together on the board with the thumb so as to form the outline of a square or oblong, with the armature in the middle.

2. Fill in the outline with similar pieces of clay, making a thickness of about $\frac{3}{4}$ inch all over.



FIG. F

3. Smooth the top with the thumb, first in one direction, and then in the other.

4. Take one end of the knitting-needle in each hand, place it across the slab close to the armature, and draw it towards you, so as to cut the top perfectly smooth and even.

5. Do this in all four directions, turning the board round.

6. Wipe the knitting-needle on the sponge each time after using it.

7. Cut the edges of the slab straight by laying the knitting-needle on it parallel with the edge of the board, and press each end down on to the board.

8. Remove any pieces that are left behind.

9. Smooth the surface with the wet forefinger.

GENERAL DIRECTIONS APPLYING TO ALL MODELS

1. Build up the mass of the object, making it smaller rather than larger than the object, unless it is desired to enlarge it.

2. Consider the proportions, the character, the general effect of light and shade.

3. From time to time hold up the modelling-board on a level with the eye, with the object and the model on it side by side in the same position, and compare them from all sides.

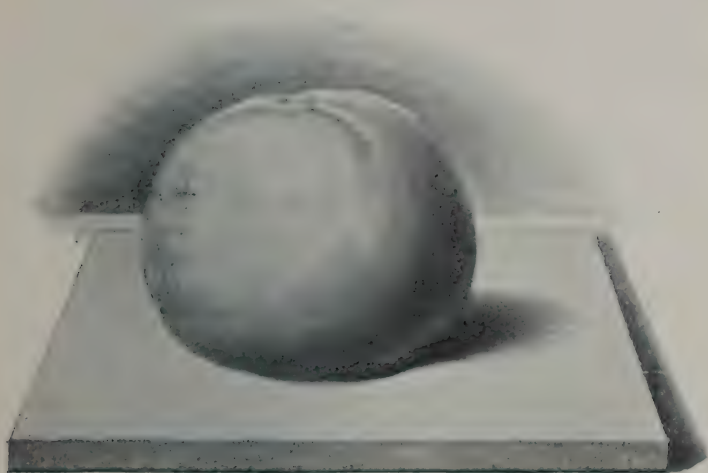
4. Observe the outlines as seen from all points, and the shape of the shadow cast by the model on the board. Also the shapes of the individual shadows on the model.

5. When the whole effect is fairly correct, put in the most noticeable details.

6. Then the minor details.

7. Give the texture of the surface, rough or smooth, &c.

MODEL NO. 1.—AN ORANGE

*Directions*

1. Make a square slab round the armature.
2. Take small pieces of stiff clay (see Section 25), and press them together on the board until a lump about the size of the Orange is made.

NOTE.—This insures the lump being solid throughout, with no holes left in the clay.

3. Take the lump in the palm of the left hand, and roll it into a ball with the palm of the right hand, with a circular motion.
4. Smooth out any marks on the surface with the thumb.
5. Hold up the ball between the thumb and finger to

observe the outline, pressing it into shape where necessary with the thumb.

NOTE.—It is not necessary to strive to obtain a perfect ball, as its shape has to be spoilt again directly to make it like the Orange. It is quite enough to make it fairly round.

6. Press the ball into the general shape of the Orange, and put it on to the armature so that it touches the slab.

7. Hold up the board on a level with the eye, with the Orange and the model on it side by side in the same position, and compare their shape, noting at the same time the general mass, the proportions, and the shapes of the shadows from all sides.

8. Copy the form in the model by putting on pieces of soft clay and smoothing away the edges with the thumb, or by pressure of the thumb where necessary.

9. Carefully notice any flat parts.

10. Make the dimple at the top with the forefinger.

11. Pass the thumb round the dimple of the Orange to feel for any depressions. Make these in the model with the side of the thumb.

12. For the calyx, roll up a tiny pill of clay between the thumb and forefinger, flatten it, and shape it with the tips of the thumb and forefinger.

13. Wet the under side on the sponge, and press it into the dimple.

14. Work it up with the tool.

15. To give the roughened appearance of the skin, roll a tiny bit of clay backwards and forwards between the thumb and forefinger to partly dry it; blunt the end, and prick the surface of the clay model lightly and closely all over with it.

16. Partly efface the pricks with the thumb, that they may not be more noticeable than in the Orange.

MODEL NO. 2.—AN APPLE



This object should be placed on its side, so that the dimples at each end can be seen, and not as in the illustration. It is best to use a piece of wicker or string for the stalk, as clay stalks break so easily.

Directions

1. Make a square slab round the armature.
2. Make a ball of clay about the same size as the Apple, (see Model No. 1, Directions 2-8), press it into shape, and fix it on to the armature.
3. Observe the difference in circumference round the stalk end and round the calyx end, copying this in the

model by putting on soft clay, or by pressure of the thumb.

4. Feel the dimple at the calyx end of the Apple with the thumb, to observe the depth and depressions around it. Make the dimple in the model with the forefinger slightly deeper, to allow for filling up with the calyx.

5. Mark the depressions with the side of the thumb, and model any little lumps by putting on soft clay.

6. Roll up a tiny pill of clay for the calyx between the thumb and forefinger, wet it on the sponge, and press it into the dimple.

7. Work it with the pointed end of the tool, carefully observing the form of the sepals in the Apple.

8. Make the dimple for the stalk with the forefinger.

9. Observe that in the Apple its sides are convex. Therefore fill it up to this shape with pieces of clay, smoothing with the tool.

10. Smooth the surface with the wet thumb.

11. Put in the stalk bending to one side.

MODEL No. 3.—A PLUM

The Plum should be placed so that the groove on it can be seen. The stalk may be made of wicker or string.

Directions

1. Make an oblong slab round the armature.

2. Build up a lump of stiff clay (see Section 25) about the size and shape of the Plum.

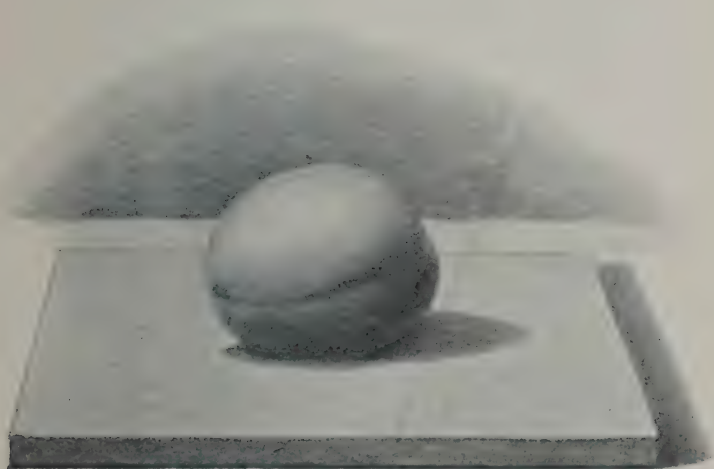
3. Smooth out any marks on the surface with the thumb.

4. Put the lump on the armature.

5. Compare the object and the model, and correct the latter where necessary (see Model No. 1, Directions 7, 8).

6. Make the dimple for the stalk with the forefinger, carefully modelling its form (see Model No. 2, Direction 9), and feeling the form in the object with the thumb.

7. Make the groove by pressing the length of the tool into the clay model, and then smooth off the edges with the tool. Do not draw it on the clay with the point of the tool.

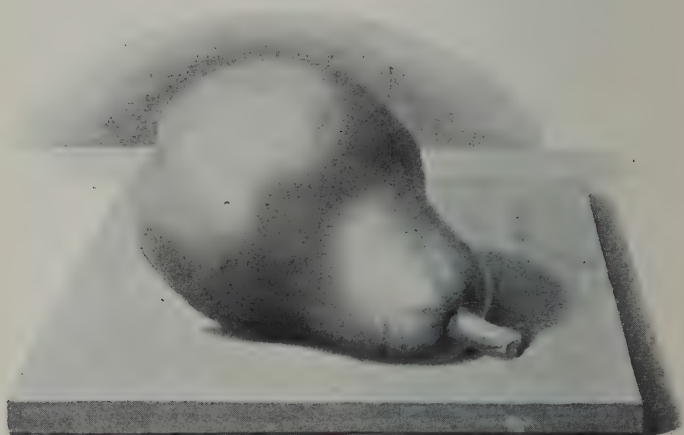


Note that in the Plum it is not the same depth along its whole length.

8. Finish the groove by smoothing the wet thumb across it, and also smooth the whole surface.

9. Put in the stalk.

MODEL NO. 4.—A PEAR



The Pear should be placed on its side, so that the modelling of the whole can be seen. Use a piece of wicker or string for the stalk.

Directions

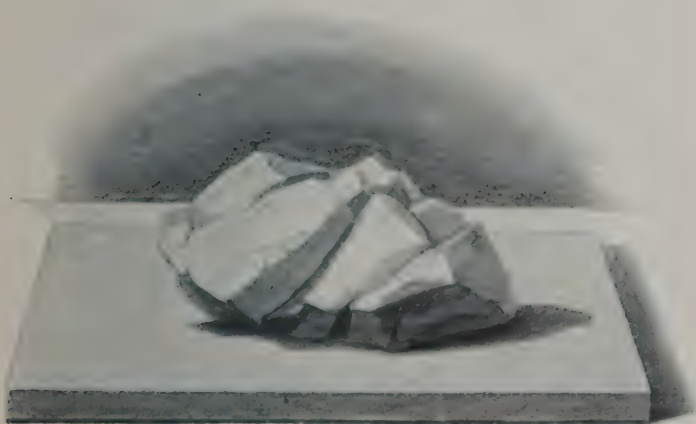
1. Make a slab round the armature.
2. Build up the mass of the Pear (see Model No. 3, Directions 2, 3), and put it on the armature.
3. Compare the mass of the object and the model, correcting the latter where necessary (see Model No. 1, Directions 7-9).
4. Feel the dimple in the calyx end of the Pear, and make it in the model with the forefinger, finishing it with the tool.

5. Carefully model the stalk end, noting that the curves on one side are convex, but concave on the other, and that the stalk is probably on one side.

6. Smooth the surface with the wet thumb.

7. Put in the stalk.

MODEL NO. 5.—A PIECE OF BROKEN STONE



Directions

1. Make a slab round the armature.

2. Build up the general shape of the Stone on the slab round the armature.

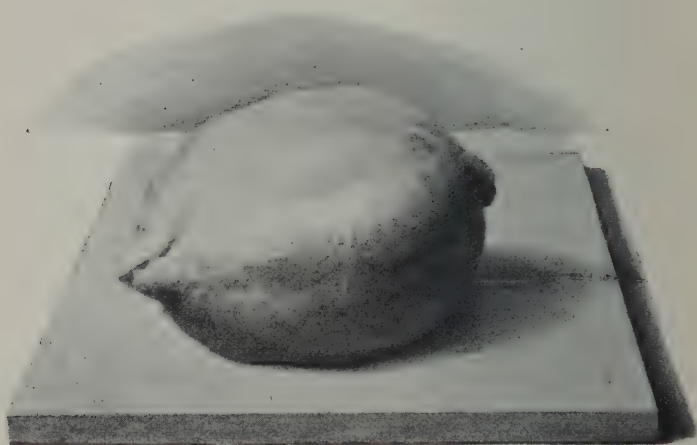
3. Make the sharp edges by putting clay on in the direction of the edge, and smoothing the thumb, first along the plane on one side of it, and then along the plane on the other.

4. Compare the masses of the object and the model (see

Model No. 1, Directions 7-9), carefully noticing the angle of inclination of the different planes.

5. Smooth with the wet thumb if the surface of the Stone is smooth. Otherwise, roughen it by dabbing with a bit of rather soft clay, or with the finger.

MODEL NO. 6.—A LEMON



Directions

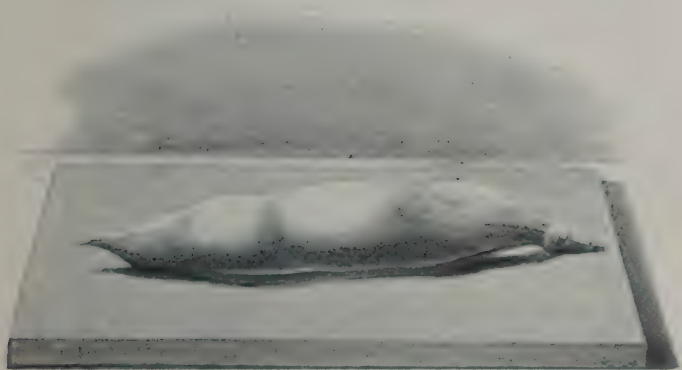
1. Make an oblong slab round the armature.
2. Build up the mass of the Lemon, and put it on the armature (see Model No. 3, Directions 2-4).
3. Compare the mass of the object and the model by holding them up on a level with the eye (see Model No. 1, Directions 7-9).

4. Work up the stalk end. Note any depressions, putting on the higher parts between these.

5. Finish the attachment of the stalk with the tool.

6. Give the texture of the surface by pricking it with a piece of clay (see Model No. 1, Directions 15, 16). The point of the clay-pricker should be blunter than that used for the Orange.

MODEL NO. 7.—A PEA POD



This object does not require the support of the armature (see Section 19).

Directions

1. Make an oblong slab away from the armature.

2. Build up the mass of the object of stiff clay (see Section 25), making it rather smaller than in the original, to allow for the modelling later. Roll it between the hands to smooth it, and put it on the slab.

3. Compare the masses of the object and the model (see Model No. 1, Directions 7-9). Model the top first, and when that is finished do the part underneath.

4. Shape the ends with the forefinger and tool.

5. Mark the join of the two parts of the pod with the tool, smoothing away the edges made in the process.

6. Smooth the surface with the wet thumb.

MODEL NO. 8.—AN ACORN



This model should be made twice its natural size.

Directions

1. Make a small oblong slab, $1\frac{1}{2}$ inches thick, round the armature.

2. Make the Acorn first, and then put the cup round it.

3. Build up the mass of the Acorn (see Model No. 3, Directions 2, 3).

4. Put it on the armature, noting the angle at which the Acorn is lying on the table.

5. Put on pieces of clay round the end for the cup, making it the right thickness and shape.

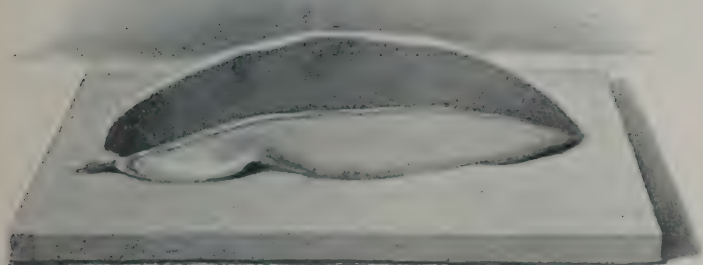
6. Finish the edge of the cup with the tool.

7. Imitate the roughness of the cup with the tool and finger.

8. Smooth the clay Acorn with the wet finger, making the point at the end.

9. Roll out a little piece of clay for the stalk, and put it in place, or use a bit of twig or string.

MODEL NO. 9.—A LAUREL LEAF



The Leaf must be copied in the position in which it lies on the table. It does not need the support of the armature (see Section 19).

Directions

1. Make a slab which will hold the Leaf, allowing a margin of $\frac{1}{2}$ inch all round.

2. Sketch the outline of the Leaf on the slab with the tool. Do not lay the Leaf on the slab and trace round it.

3. Build up the model inside the outline quite solid, beginning at the highest point, and make this stand up above the slab as much as the same part of the Leaf does above the table. Work from the highest to the lowest parts.

4. Carefully note all irregularities of surface and edge, copying these in the clay model.

5. Make the stalk solid underneath, observing its curve downwards.

6. Smooth the surface with the wet thumb.

7. The midrib looks lighter than the Leaf itself. To produce this effect it must be raised. Therefore depress the clay slightly along each side of the rib with the tool, thus leaving a narrow ridge.

8. Lightly mark the lateral ribs, if they are noticeable enough in the Leaf, by a single instead of a double depression.

9. Slightly cut out the clay underneath the model, to give it the appearance of being thin at the edge, being careful in so doing not to spoil the shape.

NOTE.—It is, of course, impossible and unnecessary to make the model as thin as the Leaf. The clay underneath should therefore only be cut out just at the edge, and the rest left solid.

MODEL No. 10.—A TOMATO

Directions

1. Make a slab round the armature.

2. Build up the mass of the object (see Model No. 3, Directions 2, 3), and put it on the armature.

3. Make the dimple which holds the calyx, with the forefinger, a little deeper than in the object, to allow for filling up with the calyx. Smooth away any edges with the forefinger.

4. If the divisions of the lobes are only slightly marked, put them in by pressure with the tool, noticing that they are deepest near the calyx, and soften them by passing the forefinger across them.



5. If the divisions are deeply marked the mass must be made somewhat smaller than the Tomato at first.

6. Then lightly draw the divisions, to show where they come, and make each lobe by putting on a piece of clay down the middle of each division, between the lines, smoothing it away on each side, so that the middle of the lobe is higher than the edges.

7. Smooth the surface with the wet thumb.

8. Count the sepals in the calyx, and make the same

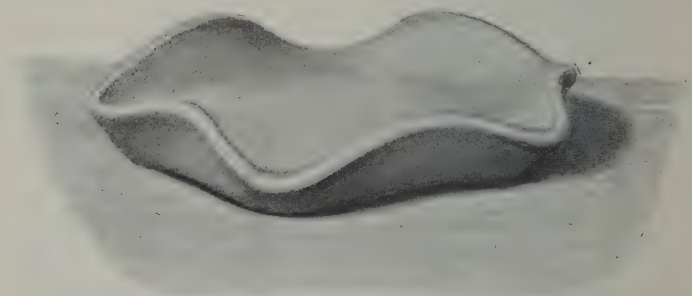
number of tiny rolls of clay, flattening them on the board, and making them pointed at one end, as in the original.

9. Press the other ends together, observing the angles between the sepals; wet the under side, and press it into the dimple.

10. Roll up a tiny clay stalk the same size as in the object, wet one end on the sponge, make a little hole in the calyx with the tool, and put it in.

11. Curl up the sepals, if necessary.

MODEL No. 11.—A SAUCER



This model and the next—the Plant Pot—should be made in the same lesson, that they may match in size, as the Plant Pot is intended to stand in the Saucer. They should not be less than $\frac{1}{8}$ inch thick all over.

Directions

1. Make two balls of clay (see Sections 15 and 26), each 2 inches in diameter. They should be made as round as possible.

2. For the Saucer, flatten one ball on the board, with the ball of the thumb, to the thickness of about $\frac{3}{4}$ inch.

3. Loosen this disc from the board, and, putting the tips of the thumbs together in the centre, take hold of the edge with the forefingers and draw the thumbs towards them, so as to hollow out the middle.

4. Do this all round the disc, turning it round and round, but keeping it on the board, and always working at the side opposite to you.

5. Be careful not to press downwards too much with the thumbs, or a hole will be made in the bottom of the saucer.

6. Take hold of the rim between the thumbs and forefingers, and pinch it to an even thickness and height all round, giving it a graceful upward curve.

7. Smooth the rim, inside and outside, in a circular direction, with the wet thumb, being careful to have the same curve upward all round.

8. Make five or six marks at equal distances on the edge, and bend it outwards at each mark between the thumb and fingers, or otherwise ornament it, making the ornamentation an essential part of the form of the Saucer.

MODEL NO. 12.—A PLANT POT

Directions

1. Take the second ball made for the last model, and, placing the thumbs back to back, push them into the middle, drawing the outside upwards with the forefingers.

2. Do this all round, turning the model round, but keeping it on the board, and always working at the side opposite to you.

3. Be very careful not to make the Pot too wide at the top, though the top must be larger in diameter than the bottom.

4. Pinch the sides to the same thickness and height all round, keeping the thumbs inside all the while.

5. Flatten the bottom, inside, with the finger.
6. Make the hole in the bottom with the forefinger,



pushing it through first from the inside, and then from the outside.

7. Finish with the wet thumb and finger, and crinkle the edge of the Pot to match the Saucer.

MODEL NO. 13.—AN ONION

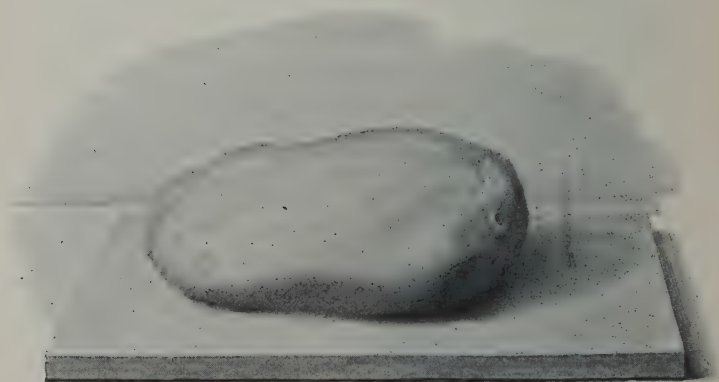
*Directions*

1. Make a square slab round the armature.
2. Roll up a ball of clay (see Model No. 1, Directions 2-5).
3. Slightly flatten it on two diametrically opposite sides, and put it on the armature, being careful to give the planes the same inclination as in the object.
4. Compare the masses of the object and the model (see Model No 1, Directions 7, 8), building up the top—which becomes thin and papery at the end—and also the rootlets.
5. Give the appearance of the rootlets by making a number of little sharp cuts with the tool, carefully observing in the object the direction these should take.

6. Finish the top end by giving any sharp twists or turns which may occur in the original.

7. Smooth the surface with the wet thumb.

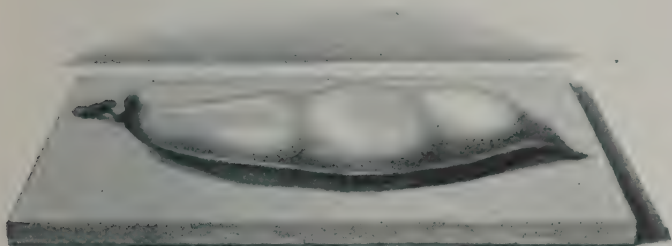
MODEL No. 14.—A POTATO



Directions

1. Make an oblong slab round the armature.
2. Proceed as for Model No. 3 (Directions 2-5).
3. Carefully observe the shape and position of the eyes in the Potato, marking these in the clay model and softening the edges.
4. Work up the dot in the eye with the pointed end of the tool.

MODEL NO. 15.—A BROAD BEAN

*Directions*

Proceed as for the Pea Pod (Model No. 7).

MODEL NO. 16.—A CHESTNUT

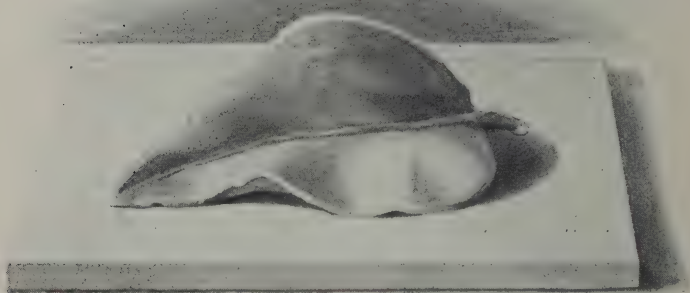


This model should be enlarged to twice its natural size.

Directions

1. Make a thick slab round the armature.
2. Build up the mass of the object on the slab round the armature.
3. Smooth away all marks in the clay with the thumb, and correct the shape by comparison with the object (see Model No. 1, Directions 7, 8).
4. Work up the point, and smooth the surface with the wet thumb.
5. Draw the outline of the scar with the tool.

MODEL NO. 17.—A POPLAR LEAF

*Directions*

Proceed as for the Laurel Leaf (Model No. 9).

MODEL No. 18.—A CARROT



The armature should be buried in the thick end of the model, and must, therefore, not be in the middle of the slab, but towards one end. Cut off the leaves to within about $\frac{1}{2}$ inch of the Carrot.

Directions

1. Make an oblong slab with the armature near one end.
2. Proceed as for Model No. 7 (Directions 2, 3).
3. Observe the different planes on the Carrot, and copy these, carefully modelling them with the thumb.
4. Do the top first, and then the part underneath.
5. Round the thick end with the thumb, and make a depression in the middle of it with the forefinger.
6. Put some clay in this depression for the stalks, and cut it with the sharp end of the tool, first observing the stalks in the Carrot.
7. Copy the marks on the Carrot, carefully noting that some are deeper than others, and that their distance from each other and their length vary.

MODEL No. 19.—A COCKLE SHELL



This model should be enlarged to twice its size.

It does not need the support of the armature (see Section 19).

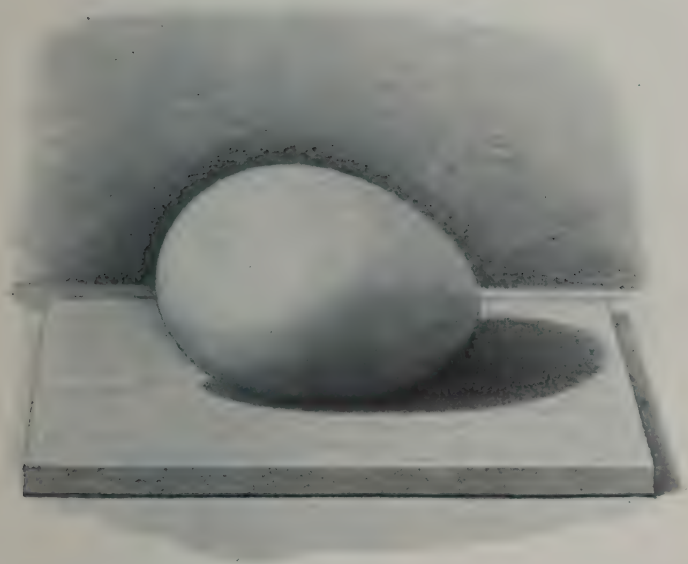
Directions

1. Make a slab away from the armature large enough to allow a margin of $\frac{1}{2}$ inch all round the model.
2. Sketch the outline of the Shell on the slab with the tool. Do not lay the Shell on the slab and trace round it.
3. Build up the shape of the Shell inside the outline, making it solid, and beginning at the highest part.
4. Compare the proportions, masses, shadows, and outlines of the object and the model (see Model No. 1, Directions 7, 8), altering the latter where necessary.

5. Smooth the surface with the wet thumb or finger.

6. Put in the grooves with the tool, observing that they all meet in one point, and smooth away any sharp edges that are made in drawing them.

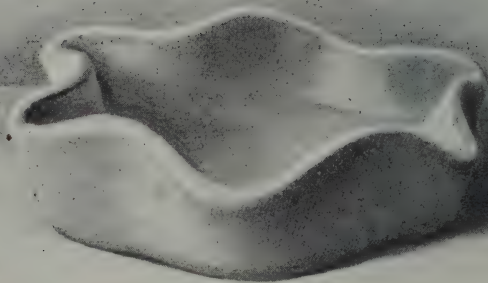
MODEL No. 20.—AN EGG



Directions

Proceed as for Model No. 3.

MODEL NO. 21.—A BON-BON DISH

*Directions*

1. Make a ball of clay (see Sections 15 and 26) $1\frac{1}{2}$ inches in diameter.
2. Flatten this to the thickness of $\frac{3}{4}$ inch.
3. Loosen the disc from the board, and hollow it out with the tips of the thumbs (see Model No. 11, Directions 3-6) till the sides are $\frac{1}{8}$ inch in thickness all over.
4. Make the sides about 1 inch in height, and let them slope outwards, the circumference at the top being wider than that at the bottom.
5. Smooth all over with the wet finger.

6. Divide the circumference into six equal parts, and at each division bend the edge inwards, being careful to make all the curves alike.

MODEL NO. 22.—A WALNUT



This model should be enlarged to twice its size.

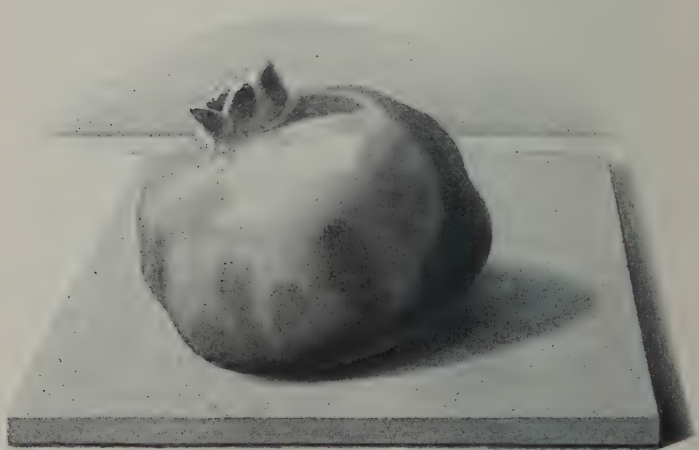
Directions

1. Proceed as for Model No. 3 (Directions 1-5).
2. Roll out a small string of clay between the finger and the board, flatten it, wet one side on the sponge, and press it round the middle of the model for the rim.
3. Work it up with the tool so that the join cannot be seen.
4. Notice that the rim is wider round one end of the Walnut than round the other, and copy this in the model.
5. Work up the point at the end with the tool, and draw

the mark on the rim showing where the two halves of the shell join.

6. Smooth the surface, and carefully draw the principal markings on the shell, partly effacing them afterwards with the finger.

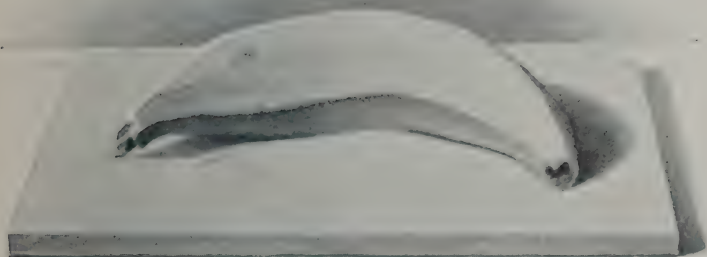
MODEL NO. 23.—A POMEGRANATE



Directions

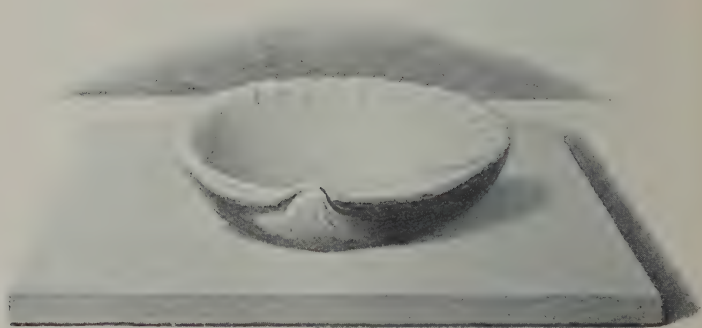
1. Proceed as for Model No. 1 (Directions 1-9).
2. Build up the calyx at the top, working it to the right shape with the finger and tool.
3. Show the divisions of the sepals by cuts in the clay.
4. Smooth the surface with the wet thumb.

MODEL No. 24.—A BANANA

*Directions*

1. Make an oblong slab round the armature.
2. Proceed as for Model No. 3 (Directions 2-5), giving the model the proper curve when it is put on to the armature.
3. Observe that the long planes of the Banana are flat or convex—rarely concave. Make these by smoothing the thumb along the clay model, and by putting on clay to form the edge of the plane (see Model No. 5, Direction 3).
4. Work up the ends to the right shape.
5. Smooth the surface with the wet thumb.

MODEL No. 25.—A COCKLE SHELL (concave)



The Shell must be placed on the table with the hollow side upwards. The model must be made twice the size of the Shell, and only the inside can be modelled.

Directions

1. Make a slab, away from the armature, which will allow a margin of $\frac{1}{2}$ inch all round the model.
2. Sketch the outline of the Shell on the slab.
3. Observe the height of the highest point of the Shell, and the angle at which it lies on the table.
4. Build up the form of the Shell, leaving the hollow in the middle, and making it solid underneath up to the edge.
5. Model the inside carefully, putting in the grooves with the tool.

6. Work up the edge, cutting it out a little underneath to show the thickness just at the edge.

7. Model the curl of the Shell, and slightly indicate the markings with the tool.

MODEL NO. 26.—AN ALMOND NUT

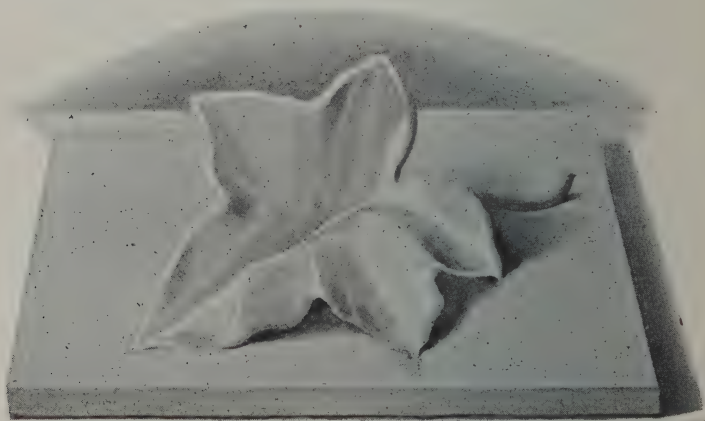


This model must be made twice the size of the object.

Directions

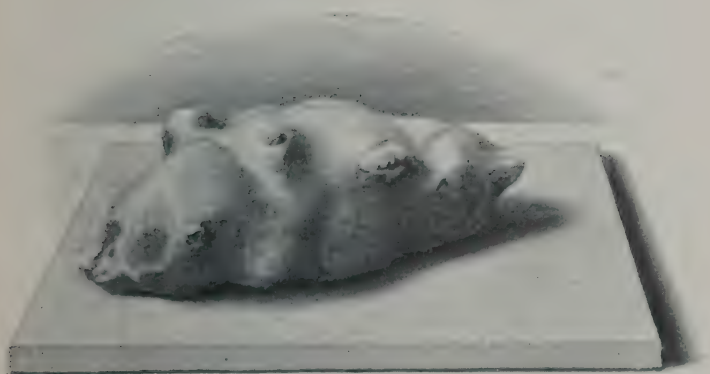
1. Proceed as for Model No. 3 (Directions 1-5).
2. Make a tiny string of clay for the rim round the Nut, flatten it, and work it on with the tool.
3. Smooth the surface with the wet thumb, and put in the dots with the sharp end of the tool, first noticing their position on the Nut.

MODEL No. 27.—AN IVY LEAF

*Directions*

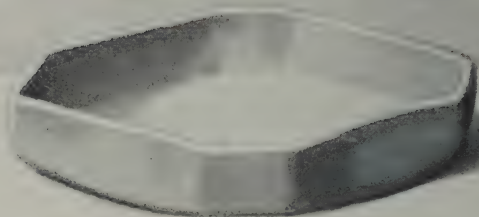
Proceed as for the Laurel Leaf (Model No. 9). In sketching the Leaf on the slab, put in first the five chief ribs, noticing the angles between them. Then draw the outline around the ribs.

MODEL NO. 28.—A JERUSALEM ARTICHOKE

*Directions*

1. Proceed as for Model No. 3 (Directions 1-4).
2. Make the mass in the first instance smaller than the Artichoke, to allow for putting on the knobs later.
3. After getting the proportions correct, put on the knobs, modelling each to its particular shape.
4. Smooth the surface with the wet finger, and roughen the ends of the knobs with the tool.

MODEL NO. 29.—AN OCTAGONAL CIGAR-ASH TRAY

*Directions*

1. Build up an oval shape of clay (see Sections 15 and 26) about 3 inches by $1\frac{1}{2}$ inches in size.
2. Flatten this on the board to the thickness of about an inch.
3. Hollow it out with the tips of the thumbs, keeping the oval shape (see Model No. 11, Directions 3-5). It should be made about $\frac{1}{8}$ inch thick all over.
4. Make the edge perpendicular, and the same thickness and height all round.
5. Smooth the surface, inside and out, with the wet thumb.
6. At the opposite ends of the longest and shortest diameters form the angles of the sides by pressure with the thumb and fingers.

MODEL NO. 30.—A BRAZIL NUT

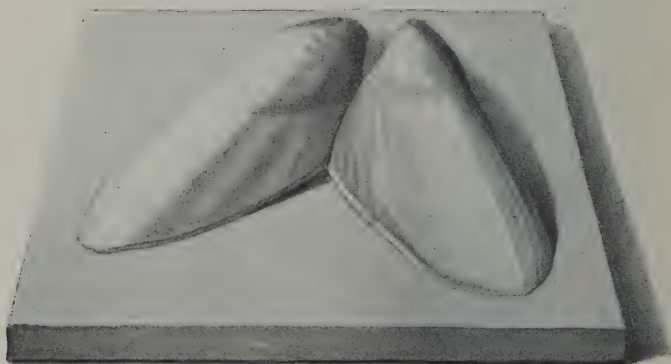


This model should be enlarged by one-half of its size.

Directions

1. Proceed as for Model No. 5 (Directions 1-4).
2. Make the marks on the surface with the pointed end of the tool, noticing that near the edges they are lines, more or less wavy, while in the middle they are dots.
3. Slightly efface the markings in places, so that they may not be too noticeable.

MODEL No. 31.—A PAIR OF MUSSEL SHELLS (convex)



The Shells should not be separated, but pressed flat on to the table, hollow side downwards, and copied in that position. The model should be made half as large again as the Shells.

Directions

Proceed as for the Cockle Shell (Model No. 19). Be careful to make the angle the two Shells form with each other correct in sketching the outline on the slab.

MODEL NO. 32.—A POPPY CAPSULE

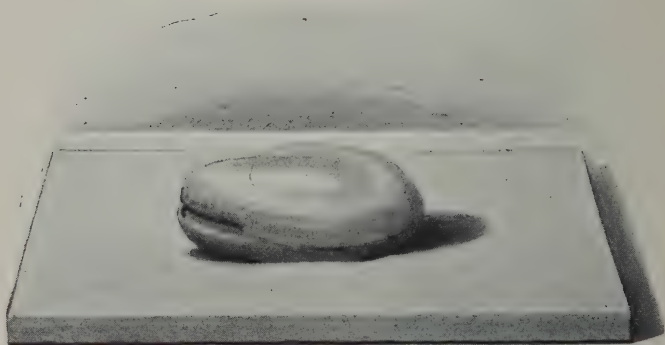


This model may be enlarged to twice its size. Leave the stalk about 1 inch long.

Directions

1. Proceed as for Model No. 1 (Directions 1-9).
2. Put on a piece of clay for the disc of the Capsule, and work it to the right shape with the tool.
3. Roll up a tiny piece of clay for the stalk, wet one end, and press it on to the model.
4. Put a little piece of clay round the join, and smooth it on with the tool.

MODEL NO. 33.—A WINDSOR BEAN



The Beans should be soaked in water for a day or more before they are used, so that they may not be wrinkled. The model should be made twice the size of the Bean. It does not need the support of the armature.

Directions

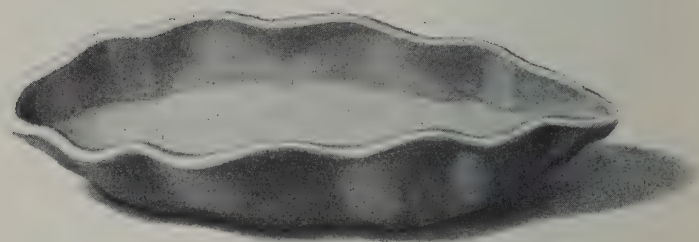
Proceed as for Model No. 7.

MODEL NO. 34.—A PORK PIE

*Directions*

1. Make a square slab round the armature.
2. Build up the shape of the Pie on it, making it solid.
3. Model the top and the rim, copying all the irregularities in the original.
4. Smooth the sides, putting in any bulges or indentations that occur in the Pie.

MODEL No. 35.—A TRINKET TRAY



The shape of this Tray is based on the form of an elongated cockle-shell.

Directions

1. Make an oval shape of clay (see Sections 15 and 26) 2 inches by 1 inch in size.

2. Make one end of it narrower than the other, and flatten to $\frac{3}{4}$ inch thickness.

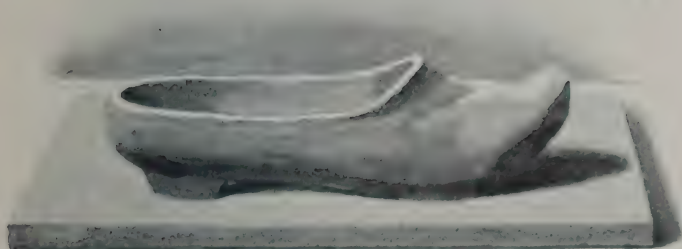
3. Hollow it out with the tips of the thumbs, making it $\frac{1}{8}$ inch thick all over (see Model No. 11, Directions 3-6), keeping the same shape all the time.

4. Make the sides slope up gradually with a graceful curve.

5. Smooth with the wet thumb.

6. Mark off even distances on each side of the centre of the wider end of the Tray, and crinkle the edge evenly on each side (see Model No. 11, Direction 8), so that the corresponding curves match each other.

MODEL No. 36.—A SABOT



The armature should be buried in the tread of the Sabot, and must, therefore, be nearer one end of the slab than the other. A Clog may be used for the model instead of the Sabot, if the latter is not obtainable.

Directions

1. Make an oblong slab with the armature towards one end.

2. Build up the mass of the object on it, turning the Sabot and the clay model about, so as to see first the width, and then the length and height.

3. Make the clay model solid throughout, and when the modelling of the outside is finished, cut out the instep, and then the inside, with the mirette, leaving the sides about $\frac{1}{8}$ inch thick.

4. Smooth with the wet thumb.

MODEL NO. 37.—A MUSHROOM



The Mushroom should be copied as it lies on the table with the stalk upwards. It does not require the support of the armature.

Directions

1. Make a square slab.
2. Sketch the outline of the top of the Mushroom on it.
3. Build up the shape of the top inside the outline, beginning in the middle, and leaving a slight depression for the stalk.
4. Make it solid underneath, except just round the edge.
5. Model the upper surface carefully, observing the undulations in the Mushroom.
6. Work up the edge with the finger and tool.
7. Mark the gills with the pointed end of the tool, noting the special direction the lines should take. Put in a few

on one side, then a few on another, and then fill up the spaces between.

8. Make some of the marks deeper than others, as in the Mushroom. Also, break them up in places, if necessary.

9. Roll up a small piece of clay for the stalk, shape it properly, wet the end on the sponge, and put it in its place.

10. Cut out the clay underneath the model a little more with the tool, being careful not to spoil the shape in so doing.

MODEL NO. 38—A PAIR OF MUSSEL SHELLS (CONCAVE)

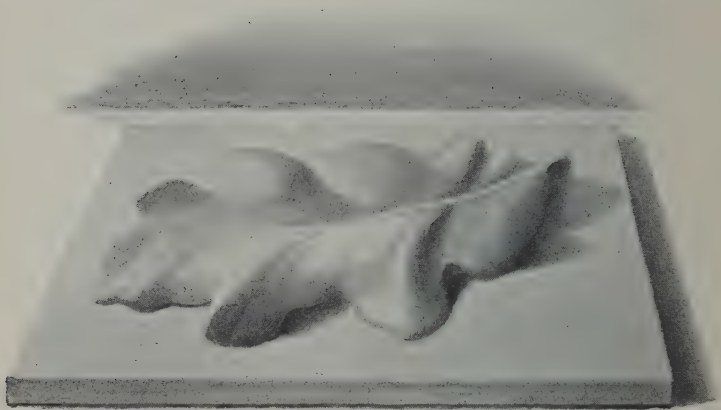


The Shells must be placed with the hollow side upwards, and the clay model made half as large again as the Shells. Only the inside can be modelled.

Directions

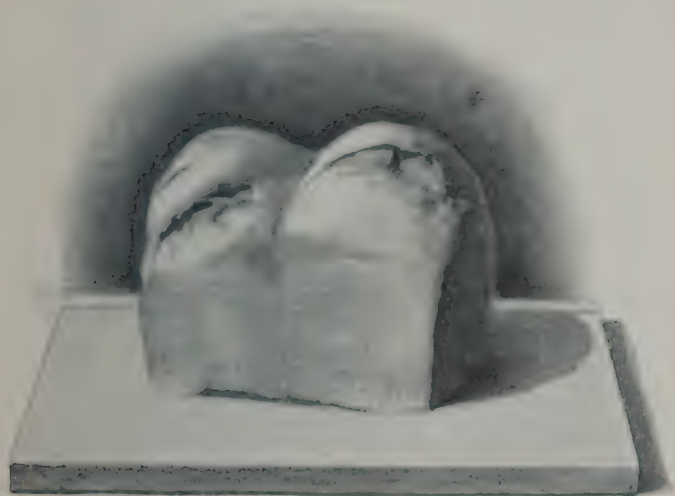
Proceed as for the Concave Cockle Shell (Model No. 29).

MODEL NO. 39.—AN OAK LEAF

*Directions*

Proceed as for the Laurel Leaf (Model No. 9).

MODEL NO. 40.—A TIN LOAF



This model must be decreased in size.

Directions

1. Make an oblong slab round the armature.
2. Build up the mass of the Loaf on the slab, being careful to make it look oblong from the beginning.
3. Compare the object and the model for the proportions and general character, noticing the curves of the top and the way it is joined to the sides (see Model No. 1, Directions 7, 8).
4. Smooth the rounded top, and work up the division

between the top and sides, giving the broken appearance with the tool.

5. Copy any indentations there may be in the sides.

MODEL NO. 41.—A TAM-O'-SHANTER



This model must be decreased in size. It should be made about $4\frac{1}{2}$ inches in diameter.

Directions

1. Make a square slab away from the armature.
2. Build up the shape of the object, making it solid, and noticing the angle which the top forms with the table.
3. Build up the mass of the tassel on the top.
4. Carefully model the top, making the edge look soft and rounded.
5. Cut out the part underneath the crown with the tool, and model it to the right shape.
6. Make deep cuts in the tassel to give the texture.

MODEL No. 42.—A CHILD'S SHOE



This model does not require the support of the armature.

Directions

1. Make a slab, and build up the mass of the toe of the Shoe on it, making it solid.

2. Roll a piece of clay between the hands, flatten it to the thickness of $\frac{1}{8}$ inch, and cut out a strip of the right length and width for the part round the heel.

3. Join this on neatly, having first built up the sole and heel of the Shoe.

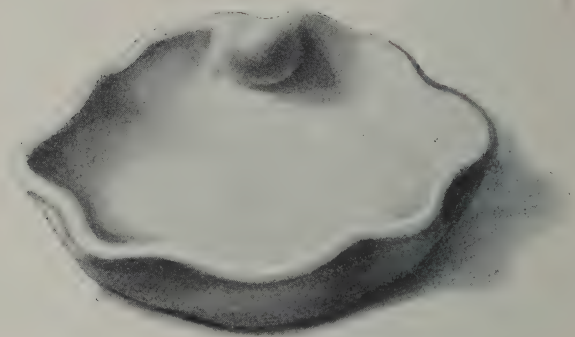
4. Carefully model the toe, putting in all the creases or other marks, and cut it out underneath the sole at the toe.

5. Hollow out the toe a little, leaving the top $\frac{1}{2}$ inch thick.

6. Roll out a string of clay for the strap, flatten it, cut the edges straight, and join it on round the heel.

7. Mark the button-hole, and put on a piece of clay for the button.

MODEL NO. 43.—A PIN TRAY



The shape of this Tray is based on the form of a Cockle Shell.

Directions

1. Make a ball of clay (see Sections 15 and 26) $1\frac{1}{2}$ inches in diameter.

2. Flatten it to the thickness of 1 inch.

3. Divide the circumference into four equal parts, and hollow out three of these with the thumbs (see Model No. 11, Directions 3-7), leaving the fourth part for the curl of the shell. The sides should be nearly 1 inch in height, and should curve upwards gradually.

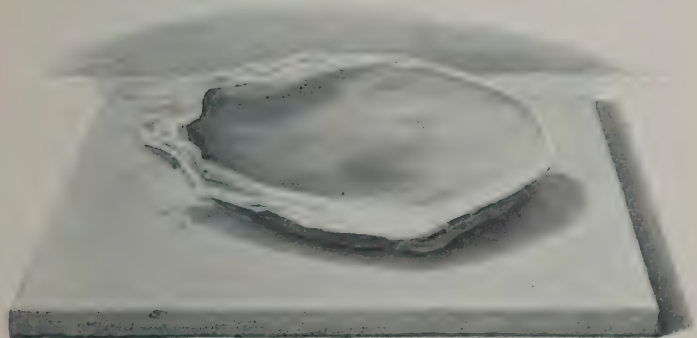
4. Place the thumbs on the outside of the fourth part, and make it curl upwards and inwards from each side, the two curves meeting in an angle in the middle of it.

5. The curl should stand up higher than the rest of the rim.

6. Smooth with the wet thumb.

7. Divide the rim of the Tray into two equal parts, and crinkle it evenly on each side of the division, so that the corresponding curves match each other.

MODEL NO. 44.—AN OYSTER SHELL



The Shell should be placed with the inside upwards. It does not need the support of the armature.

Directions

1. Make a slab of clay large enough to hold the model, with a margin of $\frac{1}{2}$ inch all round.

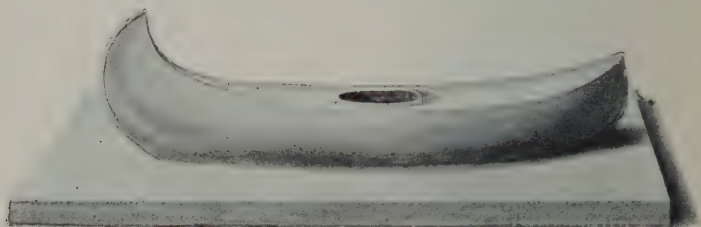
2. Sketch—not trace—the outline of the Shell on the slab.

3. Build up the mass of the Shell inside the outline, making it solid underneath, and beginning at the highest part.

4. Draw the outline of the black mark, and feel the surface of the Shell with the thumb to observe the modelling. Copy this carefully.

5. Work up the edge with the tool.
6. Cut out underneath the edge a little, to show the thickness of the Shell.
7. Smooth with the wet finger.

MODEL NO. 45.—A CANOE



This model should be made about 6 inches long.

Directions

1. Make an oblong slab.
2. Build up the mass of the Canoe, making it solid inside.
3. Model it to the right shape, and when the outside is finished, hollow out the inside with the mirette.

MODEL NO. 46.--A SYCAMORE LEAF

*Directions*

Proceed as for the Laurel Leaf (Model No. 9.)

In drawing the Leaf on the slab, put in the ribs first, and then the outline round them.

MODEL NO. 47.—A COTTAGE LOAF



This model must be decreased in size.

Directions

1. Make a square slab round the armature.
2. Build up the mass of the Loaf round the armature, noticing the angle of inclination of the top of the Loaf.
3. Model it with soft clay to the exact shape of the object (see Model No. 1, Directions 7, 8), carefully noticing all irregularities of surface.
4. Work up the indentation between the top and bottom parts.
5. Make the depression in the top, and model it to the right shape (see Model No. 2, Direction 11).

MODEL NO. 48.—A HEART-SHAPED DISH



This model is shaped like a heart, but the rounded end is higher than the pointed one.

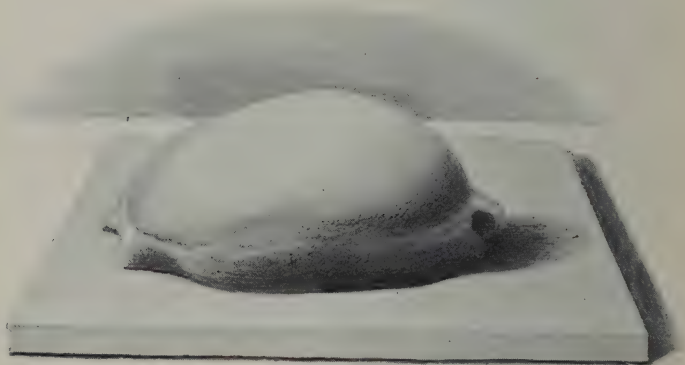
Directions

1. Make an oval lump of clay (see Sections 15 and 26) $1\frac{1}{2}$ inches long, one end of which comes almost to a point, the other being $1\frac{1}{4}$ inch across.
2. Flatten this to 1 inch in thickness.
3. Hollow it out with the thumbs, keeping the oval shape (see Model No. 11, Directions 3-7). The sides should be nearly 1 inch in height, and $\frac{1}{8}$ inch in thickness, and have a rather sharp upward curve. They should be the same height all round.
4. Smooth all over with the wet finger.

5. Make the pointed end by pressing the sides together between the thumb and forefinger.

6. Divide the other end into two equal parts, and at the point of division press the edge inwards, making the two lobes of the heart, thus making this end higher than the other.

MODEL No. 49.—A COWRIE SHELL



Unless a Shell at least 2 inches across is used as a model it should be enlarged in size.

Directions

Proceed as for the Cockle Shell (Model No. 19), but using the armature.

MODEL NO. 50.—A CHILD'S BOOT

*Directions*

1. Proceed as for the Sabot (Model No. 36, Directions 1, 2).

2. Make the clay model solid up to the ankle, and about $\frac{1}{8}$ inch thick above, except just at the edge.

3. Roll out a piece of clay for the upper part above the ankle, flatten it, cut it to the right length and width, and join it on neatly.

4. Model the toe carefully, marking the divisions of the sole and golosh, the toe-cap, and the uppers.

5. Cut out underneath the instep and sole, and make the bottom of the heel smaller than the top.

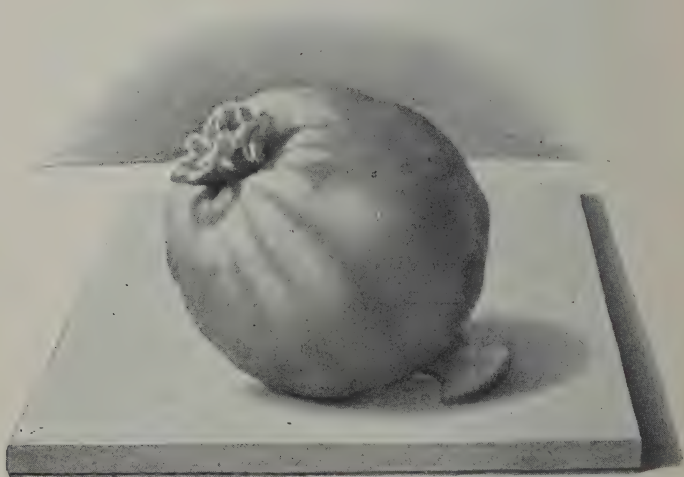
6. Model the part round the heel and ankle, keeping the

finger of the left hand inside, to prevent the clay being pressed inwards.

7. Roll up tiny pieces of clay for the lace, and put them in place, working a little hole round each end with the tool. Pierce the rest of the holes.

8. Flatten a piece of clay for the tag, cut it to the right shape, wet it, and press it on inside, giving it the same position as the one in the object.

MODEL No. 51.—A POPPY HEAD



Directions

1. Proceed as for Model No. 1 (Directions 1-8).
2. Put on clay for the disc on the top, and cut it deeply with the tool, to mark the divisions.

3. Roll up a piece of clay for the stalk, wet one end, and fasten it on, putting more clay round the join with the tool.

MODEL No. 52.—A SUGAR BOWL



Directions

1. Make a ball (see Sections 15 and 26) 2 inches in diameter, and flatten it to a disc about 1 inch thick.

2. Hollow it out with the thumbs, and when a hole $1\frac{1}{2}$ inches in diameter is made, work them underneath the edge so as to form a bulb-shaped hollow, narrow at the top.

3. Hollow the bulb out till the sides are $\frac{1}{8}$ inch thick, and make the bottom of the Bowl thinner at the edge than in the middle by smoothing it only round the sides, leaving the middle untouched.

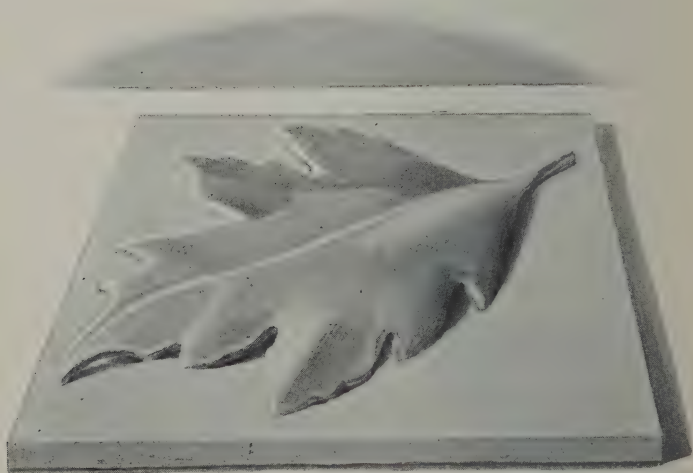
4. Work out the thick edge horizontally above the

narrow top of the bulb, between the thumb and fingers, to $\frac{1}{8}$ inch in thickness and about 1 inch in width, being careful to make it the same width all round.

5. Smooth with the wet finger all over.

6. Bend up the edge irregularly in any way fancied.

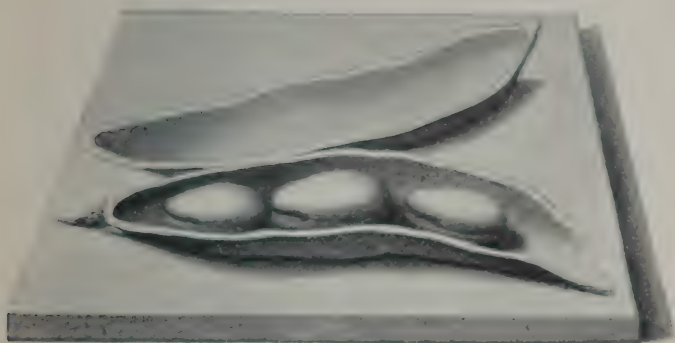
MODEL NO. 53.—A PLANE-TREE LEAF



Directions

Proceed as for the Laurel Leaf (Model No. 9).

MODEL NO. 54.—AN OPEN BEAN POD

*Directions*

Proceed as for the Pea Pod (Model No. 7).

MODEL NO. 55.—A SNAIL SHELL



This model should be enlarged to twice its size. It should be done round the armature.

Directions

1. Make a square slab round the armature.
2. Build up the mass of the Shell, making it solid.
3. Carefully draw and model the spiral with the tool.
4. Cut out underneath the edge of the Shell.
5. Hollow out the orifice a little, showing the thickness of the Shell only at the edge.

MODEL No. 56.—A BOAT



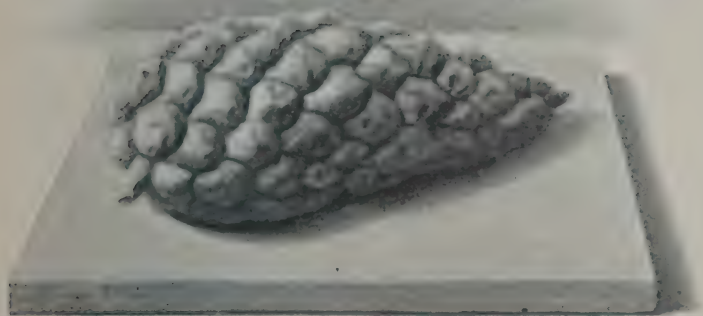
The Boat should be copied as it lies on its side on the table. The model should be made about 6 inches long. It does not need the support of the armature.

Directions

1. Make an oblong slab.
2. Build up the mass of the Boat on the slab, making it solid inside. Observe the angle which the keel makes with the table.
3. Carefully model the side which is uppermost, feeling the object with the thumb, and work only as far underneath as can be seen.

4. Scoop out the inside with the mirette, making it shallower than in the object, and the sides thicker, except at the edge.
5. Smooth the surface with the wet thumb.
6. Make the groove round the edge where the seats fit.
7. Roll up small pieces of clay for the seats, flatten them, cut the edges straight, and make them the right length.
8. Wet the ends on the sponge, and put them in place.

MODEL NO. 57.—A PINE CONE



Only unripe Cones should be used as models, and they should be enlarged to 3 or 4 inches in size.

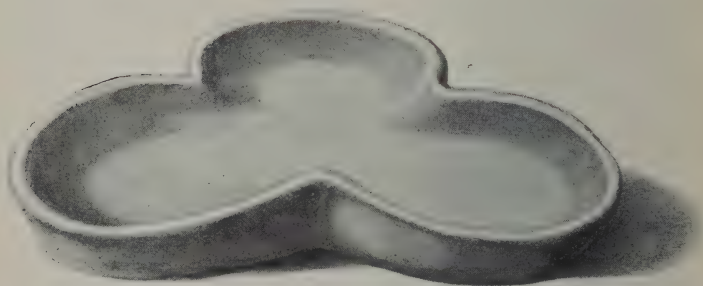
Directions

1. Proceed as for Model No. 3 (Directions 1-5).
2. Lightly draw lines across the model at the same angle

as the scales on the Cone, to indicate their divisions. Observe that they are curved, not straight.

3. Model the scales to the right shape by putting on clay.
4. Make the stalk, and put it in place.

MODEL NO. 58.—A TREFOIL-SHAPED SAUCER



Directions

1. Make a ball (see Sections 15 and 26) $1\frac{1}{2}$ inches in diameter, and flatten it to $\frac{1}{2}$ inch in thickness.
2. Divide the circumference into three equal parts, and hollow out each part with the thumb (see Model No. 11, Directions 3-7), so as to have three separate lobes.
3. Be careful to make all the lobes alike in shape, thickness, and height, and give the sides a graceful curve upwards. They should be $\frac{1}{8}$ inch in thickness.
4. Smooth the surface with the wet thumb, inside and out.

MODEL NO. 59.—A TREFOIL-SHAPED CUP

*Directions*

1. Make a ball (see Sections 15 and 26) 1 inch in diameter.
2. Proceed as for the Trefoil-shaped Saucer (Directions 2, 3), without first flattening the ball.
3. Make the sides slope outwards towards the top.
4. For the handle, roll a string of clay 2 inches long.
5. Flatten this slightly along its whole length, and flatten both ends till they are quite thin; wet them, and press them on to the cup in one of the divisions of the lobes, working them on with the tool.

MODEL NO. 60.—A WHELK SHELL



Unless Shells $2\frac{1}{2}$ inches in length are used the model should be enlarged.

— *Directions*

Proceed as for the Cockle Shell (Model No. 19), using the armature.

*GENERAL DIRECTIONS FOR ADVANCED
WORK*

For Advanced Work the student will need a larger modelling-board (the size of which depends on the models to be worked), without an armature attached, and a few more tools of different shapes. It is best that he should choose these as he feels the special need of them. The modelling-board should be made of unplanned wood, to give the clay a firmer hold.

For working most of the subjects mentioned the board should be placed on an easel, or otherwise kept in an upright position, with the light falling from one side; and the easel should be turned about from time to time, so that the light may not always fall in the same direction. When not in use the board should be laid flat, and damp cloths spread over the work to keep the clay soft.

When the subject is a study of a spray of leaves or flowers, these should be pinned or fastened on to the board by the side of the work. Casts should also be hung on a level with the copy.

The Glove and the Boy's Cap may be worked with the board flat on the table.

RELIEFS.—Wet the modelling-board with the sponge, and build up a slab of clay of the required size and thickness. A long straight-edged piece of wood may be used to scrape the top perfectly smooth. Sketch the outline of the design or subject to be copied on the slab with a tool, and broadly block-in the whole, building it up to the required height. If it is to be done in lower relief than the original, the height of the highest point must be decided on, and this

part put in first, all the rest being kept relative to it. It is the general effect of light and shade that the student must attempt to give, and he may render this by any means he likes.

When the whole has been blocked-in, it may be gradually worked up, and details put in ; but it should, as far as possible, be kept in the same state all over, and the student must not try to finish one part when others are but just begun.

CASTS OF ORNAMENT.—These are worked in the same way as reliefs.

CASTS OF ANIMALS' HEADS OR OF THE FEATURES, OR MASKS OF THE HUMAN HEAD.—These need not be worked on a slab, but can be built up directly on the modelling-board, which has first been wetted.

If it is desired to keep any of these models when finished, they should be hollowed out behind when the clay is dry enough to allow of this being done without spoiling the work, and holes bored for a string or wire, by which to hang them up. When they are perfectly dry they may be fired in a kiln, though the risk of breakage or cracking is considerable. Or they may be cast in plaster while still soft.

INDEX

ACORN, 32
 Additional instructions to the Teacher, 19
 Advanced work, 18
 " directions for, 85
 Aim of Manual, 1
 Almond nut, 51
 Apple, 25
 Armature, use of, 11
 Arrangement of Course for children, 8
 Artichoke, Jerusalem, 53
 Artistic value of Clay-Modelling, 1

BANANA, 49
 Bean, Windsor, 58
 Board, modelling, 11
 Boat, 80
 Bon-bon dish, 46
 Boot, 75
 Bowl, sugar, 77
 Brazil nut, 55
 Broad bean, 41
 " " open, 79
 Broken stone, 29
 Built up, models to be, 12

CANOE, 70
 Capsule, poppy, 57
 Care of clay, 14
 Carrot, 43
 Chestnut, 41
 Children, arrangement of Course for, 8
 " object-lesson for, 6
 " length of lesson for, 6
 Choice of methods to be allowed in work-
 ing, 5
 Cigar-ash tray, 54
 Class, number of models required for, 6
 " number of pupils in a, 6
 Clay, care of, 14
 " kind of, to be used, 12
 Clay-Modelling, artistic value of, 1
 " objections to, 15
 " powers developed by, 3
 " teaching of, to precise
 drawing, 2

Clag, 61
 Cockle shell, 54

Cockle shell, concave, 50
 Cone, pine, 81
 Copies not to be used as models, 6
 Cottage loaf, 72
 Course, arrangement of, for children, 8
 " list of models in, 16
 " order of models in, 8
 Cowrie shell, 74
 Cup, trefoil-shaped, 83

DEFINITION of 'mass,' 12
 Description of modelling board, 11
 " tools, 11
 Directions for advanced work, 85
 " general, applying to all models,
 22
 Dish, bon-bon, 46
 " heart-shaped, 73
 Drawing, teaching of, to follow modelling,
 2

EGG, 45
 Enlargement of models, 6

HEAD, poppy, 76
 Heart-shaped dish, 73
 Hollow models, 14

INFANTS' work, 17
 Instructions to the Teacher, 19
 Introduction of Clay-Modelling into
 schools, 3
 Ivy leaf, 52

JERUSALEM artichoke, 53

LAUREL leaf, 33
 Leaf, ivy, 52
 " laurel, 33
 " oak, 64
 " plane-tree, 78
 " poplar, 42
 " sycamore, 71

Lemon, 30
 Length of lesson for children, 6
 Level table to work on, 12
 List of models, 16
 Loaf, cottage, 72
 " tin, 65

MANUAL, aim of, 1
 Mass, definition of, 12
 Methods, choice of, to be allowed, 5
 " of working, 8
 Model, position of, 7
 Modelling board, 11
 " tools, 11
 Models, enlargement of, 6
 " general directions applying to all, 22
 " hollow, 14
 " list of, 16
 " number required for a class, 6
 " order of, in Course, 8
 " points to be observed in working, 7
 " suitable and unsuitable, 3
 " to be built up, 12
 Mushroom, 62
 Mussel shells, 56
 " " concave, 63

NUMBER of models required for a class, 6
 " of pupils in a class, 6
 Nut, almond, 51
 " Brazil, 55

OAK leaf, 64
 Object-lesson for children, 6
 Objections to Clay-Modelling, 15
 Objects, not copies, to be used, 6
 Octagonal cigar-ash tray, 54
 Onion, 39
 Open broad bean, 79
 Orange, 23
 Order of models in Course, 8
 " of points to be observed in working, 12
 Oyster shell, 69

PEA pod, 31
 Pear, 28
 Pin tray, 68
 Pine cone, 81
 Plane-tree leaf, 78
 Plant pot, 37
 Plum, 26
 Points to be observed in working, 7
 " order of, to be observed in working, 12
 Pomegranate, 48
 Poplar leaf, 42
 Poppy capsule, 57
 " head, 76

Pork pie, 59
 Position of model, 7
 Potato, 40
 Powers developed by Clay-Modelling, 3
 Preservation of work, 14
 " of advanced work, 86
 Pupils, number of, in a class, 6

REASONS for introduction of Clay-Modelling into schools, 3
 " for use of slab, 7

SABOT, 61
 Saucer, 36
 " trefoil-shaped, 82
 Shell, cockle, 44
 " " concave, 50
 " cowrie, 74
 " oyster, 69
 " snail, 79
 " whelk, 84
 Shells, mussel, 56
 " " concave, 63
 Shoe, 67
 Slabs, different sorts of, 19
 " directions for making, 20
 " reasons for using, 7
 Snail shell, 79
 Stone, piece of broken, 29
 Sugar bowl, 77
 Suitable models, 3
 Sycamore leaf, 71

TABLE, level, to be used, 12
 Teacher, instructions to, 19
 Teaching of Clay-Modelling before drawing, 2
 Tin loaf, 65
 Tomato, 34
 Tools, modelling, 11
 Tray, cigar-ash, 54
 " pin, 68
 Trefoil-shaped cup, 83
 " saucer, 82

UNSUITABLE models, 3
 Use of armature, 11

WALNUT, 47
 Whelk shell, 84
 Windsor bean, 58
 Work, advanced, 18
 " directions for, 85
 " for Infants, 17
 " preservation of, 14
 " of advanced, 86
 Working, method of, 8
 " models, choice of methods in, 5
 " order of points to be observed in, 12

CLASSIFIED CATALOGUE

OF

SCIENTIFIC WORKS

PUBLISHED BY

MESSRS. LONGMANS, GREEN, & CO.

LONDON: 39 PATERNOSTER ROW, E.C.

NEW YORK: 91 & 93 FIFTH AVENUE.

BOMBAY: 32 HORNBY ROAD.

CONTENTS.

| | PAGE | | PAGE |
|------------------------------------|------|-------------------------------------|------|
| <i>ADVANCED SCIENCE MANUALS</i> | - 30 | METALLURGY - - - | - 14 |
| AGRICULTURE - - - | - 27 | MINERALOGY - - - | - 14 |
| ASTRONOMY - - - | - 14 | NATURAL HISTORY - - - | - 18 |
| BACTERIOLOGY - - - | - 25 | NAVIGATION - - - | - 14 |
| BIOLOGY - - - | - 25 | OPTICS - - - | - 8 |
| BOTANY - - - | - 26 | PHOTOGRAPHY - - - | - 8 |
| BUILDING CONSTRUCTION - - | - 10 | PHYSICS - - - | - 5 |
| CHEMISTRY - - - | - 2 | PHYSIOGRAPHY - - - | - 17 |
| DYNAMICS - - - | - 6 | PHYSIOLOGY - - - | - 25 |
| ELECTRICITY - - - | - 11 | <i>PRACTICAL ELEMENTARY SCIENCE</i> | |
| <i>ELEMENTARY SCIENCE MANUALS</i> | - 30 | <i>SERIES</i> - - - | - 32 |
| ENGINEERING - - - | - 12 | <i>PROCTOR'S (R. A.) WORKS</i> - | - 15 |
| GEOLOGY - - - | - 17 | SOUND - - - | - 8 |
| HEALTH AND HYGIENE - - | - 17 | STATICS - - - | - 6 |
| HEAT - - - | - 8 | STEAM, OIL, AND GAS ENGINES - | - 9 |
| HYDROSTATICS - - - | - 6 | STRENGTH OF MATERIALS - | - 12 |
| LIGHT - - - | - 8 | TECHNOLOGY - - - | - 17 |
| <i>LONDON SCIENCE CLASS-BOOKS</i> | - 32 | TELEGRAPHY - - - | - 12 |
| <i>LONGMANS' CIVIL ENGINEERING</i> | | TELEPHONE - - - | - 12 |
| <i>SERIES</i> - - - | - 13 | <i>TEXT-BOOKS OF SCIENCE</i> - | - 29 |
| MACHINE DRAWING AND DESIGN - | - 13 | THERMODYNAMICS - - - | - 8 |
| MAGNETISM - - - | - 11 | <i>TYNDALL'S (JOHN) WORKS</i> - | - 28 |
| MANUFACTURES - - - | - 17 | VETERINARY MEDICINE, ETC. - | - 24 |
| MECHANICS - - - | - 6 | WORKSHOP APPLIANCES - | - 14 |
| MEDICINE AND SURGERY - - | - 19 | ZOOLOGY - - - | - 25 |

CHEMISTRY.

CORNISH.—PRACTICAL PROOFS OF CHEMICAL LAWS : A Course of Experiments upon the Combining Proportions of the Chemical Elements. By VAUGHAN CORNISH, M.Sc., Associate of the Owens College, Manchester. Crown 8vo., 2s.

CROOKES.—SELECT METHODS IN CHEMICAL ANALYSIS, chiefly Inorganic. By Sir WILLIAM CROOKES, F.R.S., etc. Third Edition, Rewritten and Enlarged. With 67 Woodcuts. 8vo., 21s. net.

FURNEAUX.—ELEMENTARY CHEMISTRY, Inorganic and Organic. By W. FURNEAUX, F.R.C.S., Lecturer on Chemistry, London School Board. With 65 Illustrations and 155 Experiments. Crown 8vo., 2s. 6d.

GARRETT AND HARDEN.—AN ELEMENTARY COURSE OF PRACTICAL ORGANIC CHEMISTRY. By F. C. GARRETT, M.Sc. (Vict. et Dunelm.), Assistant Lecturer and Demonstrator in Chemistry, the Durham College of Science, Newcastle-on-Tyne; and ARTHUR HARDEN, M.Sc. (Vict.), Ph.D., Assistant Lecturer and Demonstrator in Chemistry, the Owens College, Manchester. With 14 Illustrations. Crown 8vo., 2s.

HJELT.—PRINCIPLES OF GENERAL ORGANIC CHEMISTRY. By Professor E. HJELT, of Helsingfors. Translated from the German by J. BISHOP TINGLE, Ph.D., Assistant in the Laboratory of the Heriot Watt College, Edinburgh. Crown 8vo., 6s. 6d.

JAGO.—Works by W. JAGO, F.C.S., F.I.C.

INORGANIC CHEMISTRY, THEORETICAL AND PRACTICAL. With an Introduction to the Principles of Chemical Analysis, Inorganic and Organic. With 63 Woodcuts and numerous Questions and Exercises. Fcp. 8vo., 2s. 6d.

AN INTRODUCTION TO PRACTICAL INORGANIC CHEMISTRY. Crown 8vo., 1s. 6d.

INORGANIC CHEMISTRY, THEORETICAL AND PRACTICAL. A Manual for Students in Advanced Classes of the Science and Art Department. With Plate of Spectra and 78 Woodcuts. Crown 8vo., 4s. 6d.

KOLBE.—A SHORT TEXT-BOOK OF INORGANIC CHEMISTRY. By Dr. HERMANN KOLBE. Translated and Edited by T. S. HUMPHIDGE, Ph.D. With 66 Illustrations. Crown 8vo., 8s. 6d.

MENDELÉEFF.—THE PRINCIPLES OF CHEMISTRY. By D. MENDELÉEFF. Translated from the Russian (Sixth Edition) by GEORGE KAMENSKY, A.R.S.M., of the Imperial Mint, St. Petersburg; and Edited by T. A. LAWSON, B.Sc., Ph.D., Fellow of the Institute of Chemistry. With 96 Diagrams and Illustrations. 2 vols. 8vo., 36s.

MEYER.—OUTLINES OF THEORETICAL CHEMISTRY. By LOTHAR MEYER, Professor of Chemistry in the University of Tübingen. Translated by Professors P. PHILLIPS BEDSON, D.Sc., and W. CARLETON WILLIAMS, B.Sc. 8vo., 9s.

MILLER.—INTRODUCTION TO THE STUDY OF INORGANIC CHEMISTRY. By W. ALLEN MILLER, M.D., LL.D. With 71 Woodcuts. Fcp. 8vo., 3s. 6d.

CHEMISTRY—Continued.

MUIR.—Works by M. M. P. MUIR, M.A., Fellow and Prælector in Chemistry of Gonville and Caius College, Cambridge.

A COURSE OF PRACTICAL CHEMISTRY. (3 Parts.)
Part I., Elementary. Crown 8vo., 4s. 6d.

TABLES AND DIRECTIONS FOR THE QUALITATIVE CHEMICAL ANALYSIS OF MODERATELY COMPLEX MIXTURES OF SALTS. Crown 8vo., 1s. 6d.

NEWTN.—Works by G. S. NEWTH, F.I.C., F.C.S., Demonstrator in the Royal College of Science, London; Assistant Examiner in Chemistry, Science and Art Department.

CHEMICAL LECTURE EXPERIMENTS. With 224 Diagrams. Crown 8vo., 10s. 6d.

A TEXT-BOOK OF INORGANIC CHEMISTRY. With 146 Illustrations. Crown 8vo., 6s. 6d.

ELEMENTARY PRACTICAL CHEMISTRY: a Laboratory Manual for Use in Organised Science Schools. With 108 Illustrations and 254 Experiments. Crown 8vo., 2s. 6d.

OSTWALD.—**SOLUTIONS.** By W. OSTWALD, Professor of Chemistry in the University of Leipzig. Being the Fourth Book, with some additions, of the Second Edition of Ostwald's '*Lehrbuch der allgemeinen Chemie*'. Translated by M. M. PATTISON MUIR, Fellow and Prælector in Chemistry of Gonville and Caius College, Cambridge. 8vo., 10s. 6d.

PAYEN.—**INDUSTRIAL CHEMISTRY.** A Manual for use in Technical Colleges and Schools, based upon a Translation of Stohmann and Engler's German Edition of PAYEN'S '*Précis de Chimie Industrielle*'. Edited by B. H. PAUL, Ph.D. With 698 Woodcuts. 8vo., 42s.

REYNOLDS.—**EXPERIMENTAL CHEMISTRY FOR JUNIOR STUDENTS.** By J. EMERSON REYNOLDS, M.D., F.R.S., Professor of Chemistry, University of Dublin; Examiner in Chemistry, University of London. Fcp. 8vo., with numerous Woodcuts.

Part I. Introductory. Fcp. 8vo., 1s. 6d.

Part II. Non-Metals, with an Appendix on Systematic Testing for Acids. Fcp. 8vo., 2s. 6d.

Part III. Metals, and Allied Bodies. Fcp. 8vo., 3s. 6d.

Part IV. Carbon Compounds. Fcp. 8vo., 4s.

SHENSTONE.—Works by W. A. SHENSTONE, Lecturer on Chemistry in Clifton College.

THE METHODS OF GLASS-BLOWING. For the use of Physical and Chemical Students. With 42 Illustrations. Crown 8vo., 1s. 6d.

A PRACTICAL INTRODUCTION TO CHEMISTRY. Intended to give a Practical acquaintance with the Elementary Facts and Principles of Chemistry. With 25 Illustrations. Crown 8vo., 2s.

CHEMISTRY—Continued.

THORPE.—Works by T. E. THORPE, B.Sc. (Vict.), Ph.D., F.R.S., Professor of Chemistry in the Royal College of Science, South Kensington. Assisted by Eminent Contributors.

A DICTIONARY OF APPLIED CHEMISTRY. 3 vols. 8vo. Vols. I. and II., 42s. each. Vol. III., 63s.

QUANTITATIVE CHEMICAL ANALYSIS. With 88 Woodcuts. Fcp. 8vo., 4s. 6d.

THORPE AND MUIR.—QUALITATIVE CHEMICAL ANALYSIS AND LABORATORY PRACTICE. By T. E. THORPE, Ph.D., D.Sc., F.R.S., and M. M. PATTISON MUIR, M.A. With Plate of Spectra and 57 Woodcuts. Fcp. 8vo., 3s. 6d.

TILDEN.—Works by WILLIAM A. TILDEN, D.Sc. London, F.R.S., Professor of Chemistry in the Royal College of Science, South Kensington.

INTRODUCTION TO THE STUDY OF CHEMICAL PHILOSOPHY. The Principles of Theoretical and Systematic Chemistry. With 5 Woodcuts. With or without the ANSWERS of Problems. Fcp. 8vo., 4s. 6d.

PRACTICAL CHEMISTRY. The principles of Qualitative Analysis. Fcp. 8vo., 1s. 6d.

HINTS ON THE TEACHING OF ELEMENTARY CHEMISTRY IN SCHOOLS AND SCIENCE CLASSES. With 7 Illustrations. Crown 8vo., 2s.

WATTS' (H.) DICTIONARY OF CHEMISTRY. Revised and entirely Re-written by H. FORSTER MORLEY, M.A., D.Sc., Fellow of, and lately Assistant-Professor of Chemistry in, University College, London; and M. M. PATTISON MUIR, M.A., F.R.S.E., Fellow, and Prælector in Chemistry, of Gonville and Caius College, Cambridge. Assisted by Eminent Contributors. 4 vols. 8vo. Vols. I. and II., 42s. each. Vol. III., 50s. Vol. IV., 63s.

WHITELEY.—Works by R. LLOYD WHITELEY, F.I.C., Principal of the Municipal Science School, West Bromwich.

CHEMICAL CALCULATIONS. With Explanatory Notes, Problems and Answers, specially adapted for use in Colleges and Science Schools. With a Preface by Professor F. CLOWES, D.Sc. (Lond.), F.I.C. Crown 8vo., 2s.

ORGANIC CHEMISTRY: the Fatty Compounds. With 45 Illustrations. Crown 8vo., 3s. 6d.

PHYSICS, ETC.

FAIR—THE ELEMENTS OF LABORATORY WORK:
a Course of Natural Science. By A. L. FAIR, M.A., F.C.S., late Scholar of
Christ's College, Cambridge. With 22 Diagrams and numerous Questions and
Questions. Crown 8vo., 4s. 6d.

GANOT—Works by PROFESSOR GANOT. Translated and
Edited by E. ATKINSON, F.D., F.C.S.

ELEMENTARY TREATISE ON PHYSICS, Experimental
and Analytical. With a Coloured Plate and Maps, and with Questions and
Appendix of Problems and Examples with Answers. Crown 8vo., 15s.

NATURAL PHILOSOPHY FOR GENERAL READERS
(AND VIA NUTRITION). With 2 Plates, 644 Woodcuts, and an Appendix
of Questions. Crown 8vo., 7s. 6d.

GLAZEBROOK AND SHAW—PRACTICAL PHYSICS. By
E. T. GLAZEBROOK, M.A., F.C.S., and W. N. SHAW, M.A. With 121
Woodcuts. Fcp. 8vo., 7s. 6d.

GUTHRIE—MOLECULAR PHYSICS AND SOUND. By
F. GUTHRIE, Ph.D. With 91 Diagrams. Fcp. 8vo., 1s. 6d.

HENDERSON—ELEMENTARY PHYSICS. By JOHN
HENDERSON, B.Sc. (Edin.), A.I.E.E., Lecturer in Physics, Manchester Municipal
Technical School. Crown 8vo., 2s. 6d.

**HELMHOLTZ—POPULAR LECTURES ON SCIENTIFIC
SOCIETY.** By HERMANN VON HELMHOLTZ, Translated by E. ATKINSON,
F.D., F.C.S., formerly Professor of Experimental Science, Royal College. With
68 Illustrations. 2 vols., crown 8vo., 3s. 6d. each.

**HELMHOLTZ—Vol. I.—The Elements of Natural Science in General—Smith's
Scientific Lectures—The Physiological Causes of Hearing in Man—See and Gallery—The
Invention of the Natural History—The Science of the Theory of Vision—The
Construction of Force—The Art and Progress of Physical Science.**

**HELMHOLTZ—Vol. II.—Cosmic Myths. In Memory—The Origin and Significance of
Cosmological Systems—The Science of Optics in Painting—The Origin of the Faraday System
—Thought in Medicine—Scientific Frontiers in General. University—Hermann von Helmholtz
—An Introduction to the Study of the Science.**

**VAN 't HOFF—THE ARRANGEMENT OF ATOMS IN
SPACE.** By J. H. VAN 't HOFF, Second, Revised, and Enlarged Edition.
With a Preface by JENNINGS WATKINS, Professor of Chemistry at the
University of London, and an Appendix "Some elements among long-chain
Substances," by ALBERT WERBER, Professor of Chemistry at the University of
Bonn. Translated and Edited by ARTHUR DILLARD. Crown 8vo., 6s. 6d.

HATSON—ELEMENTARY PRACTICAL PHYSICS: a
Laboratory Manual for Use in General Science Schools. By W. HATSON,
B.Sc. (Oxon.), Lecturer in Physics in the Royal College of Science, London.
Assistant Lecturer in Physics, Physics and Art Experiments. With 100
Illustrations and 112 Exercises. Crown 8vo., 2s. 6d.

PHYSICS, ETC.—Continued.

WORTHINGTON.—A FIRST COURSE OF PHYSICAL LABORATORY PRACTICE. Containing 264 Experiments. By A. M. WORTHINGTON, M.A., F.R.S. With Illustrations. Crown 8vo., 4s. 6d.

WRIGHT.—ELEMENTARY PHYSICS. By MARK R. WRIGHT, Professor of Normal Education, Durham College of Science. With 242 Illustrations. Crown 8vo., 2s. 6d.

MECHANICS, DYNAMICS, STATICS, HYDRO-STATICS, ETC.

BALL.—A CLASS-BOOK OF MECHANICS. By Sir R. S. BALL, LL.D. 89 Diagrams. Fcp. 8vo., 1s. 6d.

GELDARD.—STATICS AND DYNAMICS. By C. GELDARD, M.A., formerly Scholar of Trinity College, Cambridge. Crown 8vo., 5s.

GOODEVE.—Works by T. M. GOODEVE, M.A., formerly Professor of Mechanics at the Normal School of Science, and the Royal School of Mines.

THE ELEMENTS OF MECHANISM. With 357 Woodcuts. Crown 8vo., 6s.

PRINCIPLES OF MECHANICS. With 253 Woodcuts and numerous Examples. Crown 8vo., 6s.

A MANUAL OF MECHANICS: an Elementary Text-Book for Students of Applied Mechanics. With 138 Illustrations and Diagrams, and 188 Examples taken from the Science Department Examination Papers, with Answers. Fcp. 8vo., 2s. 6d.

GRIEVE.—LESSONS IN ELEMENTARY MECHANICS. By W. H. GRIEVE, late Engineer, R.N., Science Demonstrator for the London School Board, etc.

Stage 1. With 165 Illustrations and a large number of Examples. Fcp. 8vo., 1s. 6d.

Stage 2. With 122 Illustrations. Fcp. 8vo., 1s. 6d.

Stage 3. With 103 Illustrations. Fcp. 8vo., 1s. 6d.

MECHANICS, DYNAMICS, STATICS, HYDROSTATICS, ETC.—

Continued.

MAGNUS.—Works by SIR PHILIP MAGNUS, B.Sc., B.A.

LESSONS IN ELEMENTARY MECHANICS. Introductory to the study of Physical Science. Designed for the Use of Schools, and of Candidates for the London Matriculation and other Examinations. With numerous Exercises, Examples, Examination Questions, and Solutions, etc., from 1870-1895. With Answers, and 131 Woodcuts. Fcp. 8vo., 3s. 6d.

Key for the use of Teachers only, price 5s. 3½d.

HYDROSTATICS AND PNEUMATICS. Fcp. 8vo., 1s. 6d.; or, with Answers, 2s. The Worked Solutions of the Problems, 2s.

ROBINSON.—ELEMENTS OF DYNAMICS (Kinetics and Statics). With numerous Exercises. A Text-book for Junior Students. By the Rev. J. L. ROBINSON, M.A. Crown 8vo., 6s.

SMITH.—Works by J. HAMBLIN SMITH, M.A.

ELEMENTARY STATICS. Crown 8vo., 3s.

ELEMENTARY HYDROSTATICS. Crown 8vo., 3s.

KEY TO STATICS AND HYDROSTATICS. Crown 8vo., 6s.

TATE.—EXERCISES ON MECHANICS AND NATURAL PHILOSOPHY. By THOMAS TATE, F.R.A.S. Fcp. 8vo., 2s. Key, 3s. 6d.

TAYLOR.—Works by J. E. TAYLOR, M.A., B.Sc. (Lond.), Head Master of the Central Higher Grade and Science School, Sheffield.

THEORETICAL MECHANICS, including Hydrostatics and Pneumatics. With 175 Diagrams and Illustrations, and 522 Examination Questions and Answers. Crown 8vo., 2s. 6d.

THEORETICAL MECHANICS—SOLIDS. With 163 Illustrations, 120 Worked Examples and over 500 Examples from Examination Papers, etc. Crown 8vo., 2s. 6d.

THEORETICAL MECHANICS.—FLUIDS. With 122 Illustrations, numerous Worked Examples, and about 500 Examples from Examination Papers, etc. Crown 8vo., 2s. 6d.

THORNTON.—THEORETICAL MECHANICS—SOLIDS. Including Kinematics, Statics, and Kinetics. By ARTHUR THORNTON, M.A., F.R.A.S. With 200 Illustrations, 130 Worked Examples, and over 900 Examples from Examination Papers, etc. Crown 8vo., 4s. 6d.

MECHANICS, DYNAMICS, STATICS, HYDROSTATICS, ETC.—
Continued.

TWISDEN.—Works by the Rev. JOHN F. TWISDEN, M.A.

PRACTICAL MECHANICS; an Elementary Introduction to their Study. With 855 Exercises, and 184 Figures and Diagrams. Crown 8vo., 10s. 6d.

THEORETICAL MECHANICS. With 172 Examples, numerous Exercises, and 154 Diagrams. Crown 8vo., 8s. 6d.

WILLIAMSON.—INTRODUCTION TO THE MATHEMATICAL THEORY OF THE STRESS AND STRAIN OF ELASTIC SOLIDS. By BENJAMIN WILLIAMSON, D.Sc., F.R.S. Crown 8vo., 5s.

WILLIAMSON AND TARLETON.—AN ELEMENTARY TREATISE ON DYNAMICS. Containing Applications to Thermodynamics, with numerous Examples. By BENJAMIN WILLIAMSON, D.Sc., F.R.S., and FRANCIS A. TARLETON, LL.D. Crown 8vo., 10s. 6d.

WORTHINGTON.—DYNAMICS OF ROTATION: an Elementary Introduction to Rigid Dynamics. By A. M. WORTHINGTON, M.A., F.R.S. Crown 8vo., 4s. 6d.

OPTICS AND PHOTOGRAPHY.

ABNEY.—A TREATISE ON PHOTOGRAPHY. By Captain W. DE WIVELESIE ABNEY, F.R.S., Director for Science in the Science and Art Department. With 115 Woodcuts. Fcp. 8vo., 3s. 6d.

GLAZEBROOK.—PHYSICAL OPTICS. By R. T. GLAZEBROOK, M.A., F.R.S., Fellow and Lecturer of Trinity College, Demonstrator of Physics at the Cavendish Laboratory, Cambridge. With 183 Woodcuts of Apparatus, etc. Fcp. 8vo., 6s.

WRIGHT.—OPTICAL PROJECTION: a Treatise on the Use of the Lantern in Exhibition and Scientific Demonstration. By LEWIS WRIGHT, Author of 'Light: a Course of Experimental Optics'. With 232 Illustrations. Crown 8vo., 6s.

SOUND, LIGHT, HEAT, AND THERMODYNAMICS.

CUMMING.—HEAT TREATED EXPERIMENTALLY. By LINNÆUS CUMMING, M.A. With 192 Illustrations. Crown 8vo., 4s. 6d.

DAY.—NUMERICAL EXAMPLES IN HEAT. By R. E. DAY, M.A. Fcp. 8vo., 3s. 6d.

SOUND, LIGHT, HEAT, AND THERMODYNAMICS—Continued.

EMTAGE.—LIGHT. By W. T. A. EMTAGE, M.A. With 232 Illustrations. Crown 8vo., 6s.

HELMHOLTZ.—ON THE SENSATIONS OF TONE AS A PHYSIOLOGICAL BASIS FOR THE THEORY OF MUSIC. By HERMANN VON HELMHOLTZ. Royal 8vo., 28s.

MADAN.—AN ELEMENTARY TEXT-BOOK ON HEAT. For the Use of Schools. By H. G. MADAN, M.A., F.C.S., Fellow of Queen's College, Oxford; late Assistant Master at Eton College. Crown 8vo., 9s.

MAXWELL.—THEORY OF HEAT. By J. CLERK MAXWELL, M.A., F.R.S.S., L. and E. With Corrections and Additions by Lord RAYLEIGH. With 38 Illustrations. Fcp. 8vo., 4s. 6d.

SMITH.—THE STUDY OF HEAT. By J. HAMBLIN SMITH, M.A., of Gonville and Caius College, Cambridge. Crown 8vo., 3s.

TYNDALL.—Works by JOHN TYNDALL, D.C.L., F.R.S.
See p. 27.

WORMELL.—A CLASS-BOOK OF THERMODYNAMICS. By RICHARD WORMELL, B.Sc., M.A. Fcp. 8vo., 1s. 6d.

WRIGHT.—Works by MARK R. WRIGHT, Hon. Inter. B.Sc., London.

SOUND, LIGHT, AND HEAT. With 160 Diagrams and Illustrations. Crown 8vo., 2s. 6d.

ADVANCED HEAT. With 136 Diagrams and numerous Examples and Examination Papers. Crown 8vo., 4s. 6d.

STEAM, OIL, AND GAS ENGINES.

BALE.—A HAND-BOOK FOR STEAM USERS; being Rules for Engine Drivers and Boiler Attendants, with Notes on Steam Engine and Boiler Management and Steam Boiler Explosions. By M. POWIS BALE, M.I.M.E., A.M.I.C.E. Fcp. 8vo., 2s. 6d.

BOLTON.—MOTIVE POWERS AND THEIR PRACTICAL SELECTION. By REGINALD BOLTON, Associate Member of the Institution of Civil Engineers, etc. Crown 8vo., 6s. 6d. net.

CLERK.—THE GAS AND OIL ENGINE. By DUGALD CLERK, Associate Member of the Institution of Civil Engineers, Fellow of the Chemical Society, Member of the Royal Institution, Fellow of the Institute of Patent Agents. With 228 Illustrations. 8vo., 15s.

HOLMES.—THE STEAM ENGINE. By GEORGE C. V. HOLMES, Whitworth Scholar, Secretary of the Institution of Naval Architects. With 212 Woodcuts. Fcp. 8vo., 6s.

STEAM, OIL, AND GAS ENGINES—Continued.

NORRIS.—A PRACTICAL TREATISE ON THE 'OTTO' CYCLE GAS ENGINE. By WILLIAM NORRIS, M.I.Mech.E. With 207 Illustrations. 8vo., 10s. 6d.

RIPPER.—Works by WILLIAM RIPPER, Professor of Mechanical Engineering in the Sheffield Technical School.

STEAM. With 142 Illustrations. Crown 8vo., 2s. 6d.

STEAM ENGINEERING. [*In the press.*]

SENNETT AND ORAM.—THE MARINE STEAM ENGINE. A Treatise for Engineering Students, Young Engineers and Officers of the Royal Navy and Mercantile Marine. By the late RICHARD SENNETT, Engineer-in-Chief of the Navy, etc.; and HENRY J. ORAM, Senior Engineer Inspector at the Admiralty, Inspector of Machinery in H.M. Fleet, etc. With 412 Diagrams. 8vo., 21s.

* * * This is the Third Edition of the Work originally published by Mr. Richard Sennett in 1882.

STROMEYER.—MARINE BOILER MANAGEMENT AND CONSTRUCTION. Being a Treatise on Boiler Troubles and Repairs, Corrosion, Fuels, and Heat, on the properties of Iron and Steel, on Boiler Mechanics, Workshop Practices, and Boiler Design. By C. E. STROMEYER, Member of the Institute of Naval Architects, etc. 8vo., 18s. net.

BUILDING CONSTRUCTION.

ADVANCED BUILDING CONSTRUCTION. By the Author of 'Rivingtons' Notes on Building Construction'. With 385 Illustrations. Crown 8vo., 4s. 6d.

BURRELL.—BUILDING CONSTRUCTION. By EDWARD J. BURRELL, Second Master of the People's Palace Technical School, London. With 303 Working Drawings. Crown 8vo., 2s. 6d.

SEDDON.—BUILDER'S WORK AND THE BUILDING TRADES. By Col. H. C. SEDDON, R.E., late Superintending Engineer, H.M.'s Dockyard, Portsmouth; Examiner in Building Construction, Science and Art Department, South Kensington. With numerous Illustrations. Medium 8vo., 16s.

RIVINGTONS' COURSE OF BUILDING CONSTRUCTION.

NOTES ON BUILDING CONSTRUCTION. Arranged to meet the requirements of the syllabus of the Science and Art Department of the Committee of Council on Education, South Kensington. Medium 8vo.

Part I. First Stage, or Elementary Course. With 552 Woodcuts, 10s. 6d.

Part II. Commencement of Second Stage, or Advanced Course. With 479 Woodcuts, 10s. 6d.

Part III. Materials. Advanced Course, and Course for Honours. With 188 Woodcuts, 21s.

Part IV. Calculations for Building Structures. Course for Honours. With 597 Woodcuts, 15s.

ELECTRICITY AND MAGNETISM.

- CUMMING.**—ELECTRICITY TREATED EXPERIMENTALLY. For the Use of Schools and Students. By LINNEUS CUMMING, M.A. With 242 Illustrations. Crown 8vo., 4s. 6d.
- DAY.**—EXERCISES IN ELECTRICAL AND MAGNETIC MEASUREMENTS, with Answers. By R. E. DAY. 12mo., 3s. 6d.
- DU BOIS.**—THE MAGNETIC CIRCUIT IN THEORY AND PRACTICE. By Dr. H. Du Bois, Privatdozent in the University of Berlin. Translated by E. ATKINSON, Ph.D. With 94 Illustrations. 8vo., 12s. net.
- EEBERT.**—MAGNETIC FIELDS OF FORCE: an Exposition of the Phenomena of Magnetism, Electro-Magnetism and Induction, based on the Conception of Lines of Force. By H. EEBERT, Professor of Physics in the University of Kiel. Translated by C. V. BURTON, D.Sc. Part I. With 93 Illustrations. 8vo., 10s. 6d. net.
- GORE.**—THE ART OF ELECTRO-METALLURGY, including all known Processes of Electro Deposition. By G. GORE, LL.D., F.R.S. With 56 Woodcuts. Fcp. 8vo., 6s.
- HENDERSON.**—PRACTICAL ELECTRICITY AND MAGNETISM. By JOHN HENDERSON, B.Sc. (Edin.), A.I.E.E. Lecturer in Physics, Municipal Technical School, Manchester. With 150 Illustrations and Diagrams. Crown 8vo., 6s. 6d.
- JENKIN.**—ELECTRICITY AND MAGNETISM. By FLEEMING JENKIN, F.R.S.S., L. and E., M.I.C.E. With 177 Illustrations. Fcp. 8vo., 3s. 6d.
- JOUBERT.**—ELEMENTARY TREATISE ON ELECTRICITY AND MAGNETISM. Founded on JOUBERT'S 'Traité Élémentaire d'Electricité'. By G. C. FOSTER, F.R.S., and E. ATKINSON, Ph.D. With 381 Illustrations. Crown 8vo., 7s. 6d.
- JOYCE.**—EXAMPLES IN ELECTRICAL ENGINEERING. By SAMUEL JOYCE, A.I.E.E. Crown 8vo., 5s.
- LARDEN.**—ELECTRICITY FOR PUBLIC SCHOOLS AND COLLEGES. By W. LARDEN, M.A. With 215 Illustrations, and a Series of Examination Papers, with Answers. Crown 8vo., 6s.
- MERRIFIELD.**—MAGNETISM AND DEVIATION OF THE COMPASS. By JOHN MERRIFIELD, LL.D., F.R.A.S., 18mo., 2s. 6d.
- POYSER.**—Works by A. W. POYSER, M.A.
MAGNETISM AND ELECTRICITY. With 235 Illustrations. Crown 8vo., 2s. 6d.
ADVANCED ELECTRICITY AND MAGNETISM. With 317 Illustrations. Crown 8vo., 4s. 6d.
- SLINGO AND BROOKER.**—Works by W. SLINGO and A. BROOKER.
ELECTRICAL ENGINEERING FOR ELECTRIC LIGHT ARTISANS AND STUDENTS. With 346 Illustrations. Crown 8vo., 12s.
PROBLEMS AND SOLUTIONS IN ELEMENTARY ELECTRICITY AND MAGNETISM. Embracing a Complete Set of Answers to the South Kensington Papers for the years 1893-1894, and a Series of Original Questions. With 67 Original Illustrations. Crown 8vo., 2s.
- TYNDALL.**—Works by JOHN TYNDALL, D.C.L., F.R.S. See p. 27.

TELEGRAPHY AND THE TELEPHONE.

BENNETT.—THE TELEPHONE SYSTEMS OF CONTINENTAL EUROPE. By A. R. BENNETT, Member of the Institute of Electrical Engineers; late General Manager in Scotland of the National Telephone Company, and General Manager and Electrician of the Mutual and New Telephone Companies. With 169 Illustrations. Crown 8vo., 15s.

CULLEY.—A HANDBOOK OF PRACTICAL TELEGRAPHY. By R. S. CULLEY, M.I.C.E., late Engineer-in-Chief of Telegraphs to the Post Office. With 135 Woodcuts and 17 Plates. 8vo., 16s.

PREECE AND SIVEWRIGHT.—TELEGRAPHY. By W. H. PREECE, C.B., F.R.S., V.P.Inst., C.E., etc., Engineer-in-Chief and Electrician Post Office Telegraphs; and Sir J. SIVEWRIGHT, K.C.M.G., General Manager, South African Telegraphs. With 258 Woodcuts. Fcp. 8vo., 6s.

ENGINEERING, STRENGTH OF MATERIALS, ETC.

ANDERSON.—THE STRENGTH OF MATERIALS AND STRUCTURES: the Strength of Materials as depending on their Quality and as ascertained by Testing Apparatus. By Sir J. ANDERSON, C.E., LL.D., F.R.S.E. With 66 Woodcuts. Fcp. 8vo., 3s. 6d.

BARRY.—RAILWAY APPLIANCES: a Description of Details of Railway Construction subsequent to the completion of the Earthworks and Structures. By Sir JOHN WOLFE BARRY, K.C.B., F.R.S., M.I.C.E. With 218 Woodcuts. Fcp. 8vo., 4s. 6d.

SMITH.—GRAPHICS, or the Art of Calculation by Drawing Lines, applied especially to Mechanical Engineering. By ROBERT H. SMITH, Professor of Engineering, Mason College, Birmingham. Part I. With separate Atlas of 29 Plates containing 97 Diagrams. 8vo., 15s.

STONEY.—THE THEORY OF THE STRESSES ON GIRDERS AND SIMILAR STRUCTURES. With Practical Observations on the Strength and other Properties of Materials. By BINDON B. STONEY, LL.D., F.R.S., M.I.C.E. With 5 Plates and 143 Illustrations in the Text. Royal 8vo., 36s.

UNWIN.—Works by WILLIAM CAWTHORNE UNWIN, F.R.S., B.S.C.

THE TESTING OF MATERIALS OF CONSTRUCTION.

Embracing the description of Testing Machinery and Apparatus Auxiliary to Mechanical Testing, and an Account of the most Important Researches on the Strength of Materials. With 141 Woodcuts and 5 Folding-out Plates. 8vo., 21s.

ON THE DEVELOPMENT AND TRANSMISSION OF POWER FROM CENTRAL STATIONS: being the Howard Lectures delivered at the Society of Arts in 1893. With 81 Diagrams. 8vo., 10s. net.

WARREN.—ENGINEERING CONSTRUCTION IN IRON, STEEL, AND TIMBER. By WILLIAM HENRY WARREN, Challis Professor of Civil and Mechanical Engineering, University of Sydney. With 13 Folding Plates, and 375 Diagrams. Royal 8vo., 16s. net.

MACHINE DRAWING AND DESIGN.

LOW AND BEVIS.—A MANUAL OF MACHINE DRAWING AND DESIGN. By DAVID ALLAN LOW (Whitworth Scholar), M.I. Mech.E., Professor of Engineering, East London Technical College, People's Palace, London; and ALFRED WILLIAM BEVIS (Whitworth Scholar), M.I. Mech.E., Director of Manual Training to the Birmingham School Board. With 700 Illustrations. 8vo., 7s. 6d.

LOW.—Works by DAVID ALLAN LOW, Professor of Engineering, East London Technical College.

IMPROVED DRAWING SCALES. 4d. in case.

AN INTRODUCTION TO MACHINE DRAWING AND DESIGN. With 97 Illustrations and Diagrams. Crown 8vo., 2s.

MECHANICAL ENGINEER'S POCKET-BOOK. [*In the press.*]

UNWIN.—THE ELEMENTS OF MACHINE DESIGN. By W. CAWTHORNE UNWIN, F.R.S., Professor of Engineering at the Central Institute of the City and Guilds of London Institute.

Part I. General Principles, Fastenings, and Transmissive Machinery. With 304 Diagrams, etc. Fcp. 8vo., 6s.

Part II. Chiefly on Engine Details. With 174 Woodcuts. Fcp. 8vo., 4s. 6d.

LONGMANS' CIVIL ENGINEERING SERIES.

Edited by the Author of 'Notes on Building Construction'.

TIDAL RIVERS: their (1) Hydraulics, (2) Improvement, (3) Navigation. By W. H. WHEELER, M.Inst.C.E., author of 'The Drainage of Fens and Low Lands by Gravitation and Steam Power'. With 75 Illustrations. Medium 8vo., 16s. net.

NOTES ON DOCKS AND DOCK CONSTRUCTION. By C. COLSON, M.Inst.C.E., Assistant Director of Works, Admiralty. With 365 Illustrations. Medium 8vo., 21s. net.

PRINCIPLES AND PRACTICE OF HARBOUR CONSTRUCTION. By WILLIAM SHIELD, F.R.S.E., M.Inst.C.E., and Executive Engineer, National Harbour of Refuge, Peterhead, N.B. With 97 Illustrations. Medium 8vo., 15s. net.

CALCULATIONS FOR ENGINEERING STRUCTURES. By T. CLAXTON FIDLER, M.I.C.E., Professor of Engineering in the University of Dundee; Author of 'A Practical Treatise on Bridge Construction'.
[*In preparation.*]

PRINCIPLES AND PRACTICE OF CIVIL ENGINEERING. By L. F. VERNON-HARCOURT, M.Inst.C.E., Professor of Civil Engineering at University College, London.
[*In preparation.*]

RAILWAY CONSTRUCTION. By W. H. MILLS, M.I.C.E., Engineer-in-Chief, Great Northern Railway, Ireland.
[*In preparation.*]

WORKSHOP APPLIANCES, ETC.

NORTHCOTT.—LATHES AND TURNING, Simple, Mechanical and Ornamental. By W. H. NORTHCOTT. With 338 Illustrations. 8vo., 18s.

SHELLEY.—WORKSHOP APPLIANCES, including Descriptions of some of the Gauging and Measuring Instruments, Hand-cutting Tools, Lathes, Drilling, Planing, and other Machine Tools used by Engineers. By C. P. B. SHELLEY, M.I.C.E. With an additional Chapter on Milling by R. R. LISTER. With 323 Woodcuts. Fcp. 8vo., 5s.

MINERALOGY, METALLURGY, ETC.

BAUERMAN.—Works by HILARY BAUERMAN, F.G.S.

SYSTEMATIC MINERALOGY. With 373 Woodcuts and Diagrams. Fcp. 8vo., 6s.

DESCRIPTIVE MINERALOGY. With 236 Woodcuts and Diagrams. Fcp. 8vo., 6s.

GORE.—THE ART OF ELECTRO-METALLURGY, including all known Processes of Electro-Deposition. By G. GORE, LL.D., F.R.S. With 56 Woodcuts. Fcp. 8vo., 6s.

HUNTINGTON AND M'MILLAN.—METALS: their Properties and Treatment. By A. K. HUNTINGTON, Professor of Metallurgy in King's College, London, and W. G. M'MILLAN, Lecturer on Metallurgy in Mason's College, Birmingham. With 122 Illustrations. Fcp. 8vo., 7s. 6d.

RHEAD.—METALLURGY. An Elementary Text-Book. By E. C. RHEAD, Lecturer on Metallurgy at the Municipal Technical School, Manchester. With 94 Illustrations. Fcp. 8vo., 3s. 6d.

RUTLEY.—THE STUDY OF ROCKS: an Elementary Text-book of Petrology. By F. RUTLEY, F.G.S. With 6 Plates and 88 Woodcuts. Fcp. 8vo., 4s. 6d.

ASTRONOMY, NAVIGATION, ETC.

ABBOTT.—ELEMENTARY THEORY OF THE TIDES: the Fundamental Theorems Demonstrated without Mathematics and the Influence on the Length of the Day Discussed. By T. K. ABBOTT, B.D., Fellow and Tutor, Trinity College, Dublin. Crown 8vo., 2s.

BALL.—Works by Sir ROBERT S. BALL, LL.D., F.R.S.

ELEMENTS OF ASTRONOMY. With 130 Figures and Diagrams. Fcp. 8vo., 6s. 6d.

A CLASS-BOOK OF ASTRONOMY. With 41 Diagrams. Fcp. 8vo., 1s. 6d.

ASTRONOMY, NAVIGATION, ETC.—Continued.

CLERKE.—THE SYSTEM OF THE STARS. By AGNES M. CLERKE. With 6 Plates, and numerous Illustrations. 8vo., 21s.

GOODWIN.—AZIMUTH TABLES FOR THE HIGHER DECLINATIONS. (Limits of Declination 24° to 30° , both inclusive.) Between the Parallels of Latitude 0° and 60° . With Examples of the Use of the Tables in English and French. By H. B. GOODWIN, Naval Instructor, Royal Navy. Royal 8vo., 7s. 6d.

HERSCHEL.—OUTLINES OF ASTRONOMY.—By Sir JOHN F. W. HERSCHEL, Bart., K.H., etc. With 9 Plates, and numerous Diagrams. 8vo., 12s.

LOWELL.—MARS. By PERCIVAL LOWELL, Fellow American Academy, Member Royal Asiatic Society, Great Britain and Ireland, etc. With 24 Plates. 8vo., 12s. 6d.

MARTIN.—NAVIGATION AND NAUTICAL ASTRONOMY. Compiled by Staff Commander W. R. MARTIN, R.N. Royal 8vo., 18s.

MERRIFIELD.—A TREATISE ON NAVIGATION. For the Use of Students. By J. MERRIFIELD, LL.D., F.R.A.S., F.M.S. With Charts and Diagrams. Crown 8vo., 5s.

PARKER.—ELEMENTS OF ASTRONOMY. With Numerous Examples and Examination Papers. By GEORGE W. PARKER, M.A., of Trinity College, Dublin. With 84 Diagrams. 8vo., 5s. net.

WEBB.—CELESTIAL OBJECTS FOR COMMON TELESCOPES. By the Rev. T. W. WEBB, M.A., F.R.A.S. Fifth Edition, Revised and greatly Enlarged by the Rev. T. E. ESPIN, M.A., F.R.A.S. (Two Volumes.) Vol. I., with Portrait and a Reminiscence of the Author, 2 Plates, and numerous Illustrations. Crown 8vo., 6s. Vol. II., with numerous Illustrations. Crown 8vo., 6s. 6d.

WORKS BY RICHARD A. PROCTOR.

OLD AND NEW ASTRONOMY. With 21 Plates and 472 Illustrations in the Text. 4to., 21s.

THE MOON: Her Motions, Aspect, Scenery, and Physical Condition. With many Plates and Charts, Wood Engravings, and 2 Lunar Photographs. Crown 8vo., 3s. 6d.

THE UNIVERSE OF STARS: Researches into, and New Views respecting the Constitution of the Heavens. With 22 Charts (4 Coloured), and 22 Diagrams. 8vo., 10s. 6d.

OTHER WORLDS THAN OURS: the Plurality of Worlds Studied Under the Light of Recent Scientific Researches. With 14 Illustrations; Map, Charts, etc. Crown 8vo., 3s. 6d.

WORKS BY RICHARD A. PROCTOR—Continued.

- OUR PLACE AMONG INFINITIES: a Series of Essays contrasting our Little Abode in Space and Time with the Infinities around us. Crown 8vo., 3s. 6d.
- MYTHS AND MARVELS OF ASTRONOMY. Crown 8vo., 3s. 6d.
- LIGHT SCIENCE FOR LEISURE HOURS: Familiar Essays on Scientific Subjects. Natural Phenomena, etc. 3 vols., crown 8vo., 5s. each.
- THE ORBS AROUND US; Essays on the Moon and Planets, Meteors and Comets, the Sun and Coloured Pairs of Suns. Crown 8vo., 3s. 6d.
- THE EXPANSE OF HEAVEN: Essays on the Wonders of the Firmament. Crown 8vo., 3s. 6d.
- OTHER SUNS THAN OURS: a Series of Essays on Suns—Old, Young, and Dead. With other Science Gleanings. Two Essays on Whist, and Correspondence with Sir John Herschel. With 9 Star-Maps and Diagrams. Crown 8vo., 3s. 6d.
- HALF-HOURS WITH THE TELESCOPE: a Popular Guide to the Use of the Telescope as a means of Amusement and Instruction. With 7 Plates. Fcp. 8vo., 2s. 6d.
- NEW STAR ATLAS FOR THE LIBRARY, the School, and the Observatory, in Twelve Circular Maps (with Two Index-Plates). With an Introduction on the Study of the Stars. Illustrated by 9 Diagrams. Crown 8vo., 5s.
- THE SOUTHERN SKIES: a Plain and Easy Guide to the Constellations of the Southern Hemisphere. Showing in 12 Maps the position of the principal Star-Groups night after night throughout the year. With an Introduction and a separate Explanation of each Map. True for every Year. 4to., 5s.
- HALF-HOURS WITH THE STARS: a Plain and Easy Guide to the Knowledge of the Constellations. Showing in 12 Maps the position of the principal Star-Groups night after night throughout the year. With Introduction and a separate Explanation of each Map. True for every Year. 4to., 3s. 6d.
- LARGER STAR ATLAS FOR OBSERVERS AND STUDENTS. In Twelve Circular Maps, showing 6000 Stars, 1500 Double Stars, Nebulæ, etc. With 2 Index-Plates. Folio, 15s.
- THE STARS IN THEIR SEASONS: an Easy Guide to a Knowledge of the Star-Groups. In 12 Large Maps. Imperial 8vo., 5s.
- ROUGH WAYS MADE SMOOTH. Familiar Essays on Scientific Subjects. Crown 8vo., 3s. 6d.
- PLEASANT WAYS IN SCIENCE. Crown 8vo., 3s. 6d.
- NATURE STUDIES. By R. A. PROCTOR, GRANT ALLEN, A. WILSON, T. FOSTER, and E. CLODD. Crown 8vo., 3s. 6d.
- LEISURE READINGS. By R. A. PROCTOR, E. CLODD, A. WILSON, T. FOSTER, and A. C. RANYARD. Crown 8vo., 3s. 6d.

MANUFACTURES, TECHNOLOGY, ETC.

BELL.—JACQUARD WEAVING AND DESIGNING. By F. T. BELL, Medallist in Honours and Certificated Teacher in 'Linen Manufacturing' and in 'Weaving and Pattern Designing,' City and Guilds of London Institute. With 199 Diagrams. 8vo., 12s. net.

LUPTON.—MINING. An Elementary Treatise on the Getting of Minerals. By ARNOLD LUPTON, M.I.C.E., F.G.S., etc. With 596 Diagrams and Illustrations. Crown 8vo., 9s. net.

MORRIS AND WILKINSON.—THE ELEMENTS OF COTTON SPINNING. By JOHN MORRIS and F. WILKINSON. With a Preface by Sir B. A. DOBSON, C.E., M.I.M.E. With 169 Diagrams and Illustrations. Crown 8vo., 7s. 6d. net.

SHARP.—BICYCLES AND TRICYCLES: an Elementary Treatise on their Design and Construction. With Examples and Tables. By ARCHIBALD SHARP, B.Sc., Whitworth Scholar; Associate Member of the Institution of Civil Engineers. With 565 Illustrations and Diagrams. Crown 8vo., 15s.

TAYLOR.—COTTON WEAVING AND DESIGNING. By JOHN T. TAYLOR. With 373 Diagrams. Crown 8vo., 7s. 6d. net.

WATTS.—AN INTRODUCTORY MANUAL FOR SUGAR GROWERS. By FRANCIS WATTS, F.C.S., F.I.C. With 20 Illustrations. Crown 8vo., 6s.

PHYSIOGRAPHY AND GEOLOGY.

BIRD.—Works by CHARLES BIRD, B.A.

ELEMENTARY GEOLOGY. With Geological Map of the British Isles, and 247 Illustrations. Crown 8vo., 2s. 6d.

ADVANCED GEOLOGY. A Manual for Students in Advanced Classes and for General Readers. With over 300 Illustrations, a Geological Map of the British Isles (coloured), and a set of Questions for Examination. Crown 8vo., 7s. 6d.

THORNTON.—Works by J. THORNTON, M.A.

ELEMENTARY PRACTICAL PHYSIOGRAPHY (for Section I. of the New Syllabus of the Science and Art Department). With 215 Illustrations. Crown 8vo., 2s. 6d.

ELEMENTARY PHYSIOGRAPHY: an Introduction to the Study of Nature. With 12 Maps and 247 Illustrations. With Appendix on Astronomical Instruments and Measurements. Crown 8vo., 2s. 6d.

ADVANCED PHYSIOGRAPHY. With 6 Maps and 203 Illustrations. Crown 8vo., 4s. 6d.

HEALTH AND HYGIENE.

BRODRIBB.—MANUAL OF HEALTH AND TEMPERANCE. By T. BRODRIBB, M.A. With Extracts from Gough's 'Temperance Orations'. Revised and Edited by the Rev. W. RUTHVEN PYM, M.A., Member of the Sheffield School Board. Crown 8vo., 1s. 6d.

HEALTH AND HYGIENE—Continued.

BUCKTON.—HEALTH IN THE HOUSE; Twenty-five Lectures on Elementary Physiology. By Mrs. C. M. BUCKTON. With 41 Woodcuts and Diagrams. Crown 8vo., 2s.

CORFIELD.—THE LAWS OF HEALTH. By W. H. CORFIELD, M.A., M.D. Fcp. 8vo., 1s. 6d.

NOTTER AND FIRTH.—Works by J. L. NOTTER, M.A., M.D., and R. H. FIRTH, F.R.C.S.

HYGIENE. With 95 Illustrations. Crown 8vo., 3s. 6d.

PRACTICAL DOMESTIC HYGIENE. With 83 Illustrations. Crown 8vo., 2s. 6d.

POORE.—Works by GEORGE VIVIAN POORE, M.D.

ESSAYS ON RURAL HYGIENE. Crown 8vo., 6s. 6d.

THE DWELLING-HOUSE. With 36 Illustrations. Crown 8vo., 3s. 6d.

WILSON.—A MANUAL OF HEALTH-SCIENCE: adapted for use in Schools and Colleges. By ANDREW WILSON, F.R.S.E., F.L.S., etc. With 74 Illustrations. Crown 8vo., 2s. 6d.

NATURAL HISTORY.

FURNEAUX.—Works by WILLIAM FURNEAUX, F.R.G.S.

THE OUTDOOR WORLD; or, The Young Collector's Handbook. With 18 Plates, 16 of which are coloured, and 549 Illustrations in the Text. Crown 8vo., 7s. 6d.

LIFE IN PONDS AND STREAMS. With 8 Coloured Plates and 331 Illustrations in the Text. Crown 8vo., 7s. 6d.

BUTTERFLIES AND MOTHS (British). With 12 Coloured Plates and 241 Illustrations in the Text. 7s. 6d.

HUDSON.—BRITISH BIRDS. By W. H. HUDSON, C.M.Z.S. With 8 Coloured Plates from Original Drawings by A. THORBURN, and 8 Plates and 100 Figures by C. E. LODGE, and 3 Illustrations from Photographs. Crown 8vo., 7s. 6d.

STANLEY.—A FAMILIAR HISTORY OF BIRDS. By E. STANLEY, D.D., formerly Bishop of Norwich. With 160 Illustrations. Crown 8vo., 3s. 6d.

MEDICINE AND SURGERY.

ASHBY.—NOTES ON PHYSIOLOGY FOR THE USE OF STUDENTS PREPARING FOR EXAMINATION. By HENRY ASHBY, M.D. Lond., F.R.C.P., Physician to the General Hospital for Sick Children, Manchester; formerly Demonstrator of Physiology, Liverpool School of Medicine. Sixth Edition, thoroughly Revised. With 141 Illustrations. Fcp. 8vo., 5s.

ASHBY AND WRIGHT.—THE DISEASES OF CHILDREN, MEDICAL AND SURGICAL. By HENRY ASHBY, M.D., Lond., F.R.C.P., Physician to the General Hospital for Sick Children, Manchester; and G. A. WRIGHT, B.A., M.B. Oxon., F.R.C.S., Eng., Assistant Surgeon to the Manchester Royal Infirmary, and Surgeon to the Children's Hospital. Enlarged and Improved Edition. With 192 Illustrations. 8vo., 25s.

BENNETT.—Works by WILLIAM H. BENNETT, F.R.C.S., Surgeon to St. George's Hospital; Member of the Board of Examiners, Royal College of Surgeons of England.

CLINICAL LECTURES ON VARICOSE VEINS OF THE LOWER EXTREMITIES. With 3 Plates. 8vo., 6s.

ON VARICOCELE; A PRACTICAL TREATISE. With 4 Tables and a Diagram. 8vo., 5s.

CLINICAL LECTURES ON ABDOMINAL HERNIA: chiefly in relation to Treatment, including the Radical Cure. With 12 Diagrams in the Text. 8vo., 8s. 6d.

BENTLEY.—A TEXT-BOOK OF ORGANIC MATERIA MEDICA. Comprising a Description of the Vegetable and Animal Drugs of the British Pharmacopœia, with some others in common use. Arranged Systematically, and Especially Designed for Students. By ROBERT BENTLEY, M.R.C.S. Eng., F.L.S. With 62 Illustrations on Wood. Crown 8vo., 7s. 6d.

BRODIE.—THE ESSENTIALS OF EXPERIMENTAL PHYSIOLOGY. For the Use of Students. By T. G. BRODIE, M.D., Lecturer on Physiology, St. Thomas's Hospital Medical School. With 2 Plates and 177 Illustrations in the Text. 8vo., 6s. 6d.

CABOT.—A GUIDE TO THE CLINICAL EXAMINATION OF THE BLOOD FOR DIAGNOSTIC PURPOSES. By RICHARD C. CABOT, M.D. With 3 Coloured Plates and 28 Illustrations in the Text. 8vo., 16s.

CLARKE.—Works by J. JACKSON CLARKE, M.B. Lond., F.R.C.S., Assistant Surgeon at the North-west London and City Orthopædic Hospitals, late Senior Demonstrator of Anatomy, Demonstrator of Bacteriology, and Curator of the Museum in St. Mary's Hospital Medical School, and Pathologist to St. Mary's Hospital.

SURGICAL PATHOLOGY AND PRINCIPLES. With 194 Illustrations. Crown 8vo., 10s. 6d.

POST-MORTEM EXAMINATIONS IN MEDICO-LEGAL AND ORDINARY CASES. With Special Chapters on the Legal Aspects of Post Mortems, and on Certificates of Death. Fcp. 8vo., 2s. 6d.

MEDICINE AND SURGERY—Continued.

COATS.—A MANUAL OF PATHOLOGY. By JOSEPH COATS, M.D., Professor of Pathology in the University of Glasgow. Third Edition. Revised throughout. With 507 Illustrations. 8vo., 31s. 6d.

COOKE.—Works by THOMAS COOK, F.R.C.S. Eng., B.A., B.Sc., M.D., Paris, Senior Assistant Surgeon to the Westminster Hospital.

APHORISMS IN APPLIED ANATOMY AND OPERATIVE SURGERY. Including 100 Typical *vivâ voce* Questions on Surface Marking, etc. Crown 8vo., 3s. 6d.

DISSECTION GUIDES. Aiming at Extending and Facilitating such Practical work in Anatomy as will be specially useful in connection with an ordinary Hospital Curriculum. 8vo., 10s. 6d.

DAKIN.—A HANDBOOK OF MIDWIFERY. By WILLIAM RADFORD DAKIN, M.D., F.R.C.P., Obstetric Physician and Lecturer on Midwifery at St. George's Hospital, etc. With 394 Illustrations. Large crown 8vo., 18s.

DICKINSON.—Works by W. HOWSHIP DICKINSON, M.D. Cantab., F.R.C.P., Physician to, and Lecturer on Medicine at, St. George's Hospital, Consulting Physician to the Hospital for Sick Children.

ON RENAL AND URINARY AFFECTIONS. With 12 Plates and 122 Woodcuts. Three Parts. 8vo., £3 4s. 6d.

THE TONGUE AS AN INDICATION OF DISEASE; being the Lumleian Lectures delivered at the Royal College of Physicians in March, 1888. 8vo., 7s. 6d.

OCCASIONAL PAPERS ON MEDICAL SUBJECTS, 1855-1896. 8vo., 12s.

DUCKWORTH.—THE SEQUELS OF DISEASE: being the Lumleian Lectures delivered in the Royal College of Physicians, 1896. Together with Observations on Prognosis in Disease. By Sir DYCE DUCKWORTH, M.D., LL.D., Fellow and Treasurer of the Royal College of Physicians, etc. 8vo., 10s. 6d.

ERICHSEN.—THE SCIENCE AND ART OF SURGERY; a Treatise on Surgical Injuries, Diseases, and Operations. By Sir JOHN ERICHSEN, Bart., F.R.S., LL.D. Edin., Hon. M.Ch. and F.R.C.S. Ireland, late Surgeon Extraordinary to H.M. the Queen. Illustrated by nearly 1000 Engravings on Wood. 2 vols. Royal 8vo., 48s.

FOWLER AND GOODLEE.—THE DISEASES AND INJURIES OF THE LUNGS AND PLEURA. By JAMES KINGSTON FOWLER, M.A., M.D., F.R.C.B., Physician and Lecturer on Pathological Anatomy, Middlesex Hospital, etc.; and RICKMAN J. GOODLEE, B.A. Lond., M.B., F.R.C.S., etc. With Illustrations. [In the press,

MEDICINE AND SURGERY—Continued.

GARROD.—Works by SIR ALFRED BARING GARROD, M.D., F.R.S., etc., Physician Extraordinary to H.M. the Queen; Consulting Physician to King's College Hospital; late Vice-President of the Royal College of Physicians.

A TREATISE ON GOUT AND RHEUMATIC GOUT (RHEUMATOID ARTHRITIS). Third Edition, thoroughly Revised and Enlarged. With 5 Plates, comprising 21 Figures (14 Coloured), and 27 Illustrations engraved on Wood. 8vo., 2rs.

THE ESSENTIALS OF MATERIA MEDICA AND THERAPEUTICS. The Thirteenth Edition, Revised and Edited, under the supervision of the Author, by NESTOR THIRARD, M.D. Lond., F.R.C.P., Professor of Materia Medica and Therapeutics in King's College, London, etc. Crown 8vo., 12s. 6d.

GRAY.—**ANATOMY, DESCRIPTIVE AND SURGICAL.** By HENRY GRAY, F.R.S., late Lecturer on Anatomy at St. George's Hospital. The Fourteenth Edition, re-edited by T. PICKERING PICK, Surgeon to St. George's Hospital, Inspector of Anatomy in England and Wales, late Member of the Court of Examiners, Royal College of Surgeons of England. With 705 large Woodcut Illustrations, a large proportion of which are Coloured, the Arteries being coloured red, the Veins blue, and the Nerves yellow. The attachments of the muscles to the bones, in the section on Osteology, are also shown in coloured outline. Royal 8vo., 36s.

HALFORD.—**THE LIFE OF SIR HENRY HALFORD, Bart.** G.C.H., M.D., F.R.S., President of the Royal College of Physicians, Physician to George III., George IV., William IV., and to Her Majesty Queen Victoria. By WILLIAM MUNK, M.D., F.S.A., Fellow and late Vice-President of the Royal College of Physicians of London. With 2 Portraits. 8vo., 12s. 6d.

HALLIBURTON.—Works by W. D. HALLIBURTON, M.D., F.R.S., M.R.C.P., Professor of Physiology in King's College, London; Lecturer on Physiology at the London School of Medicine for Women.

A TEXT-BOOK OF CHEMICAL PHYSIOLOGY AND PATHOLOGY. With 104 Illustrations. 8vo., 28s.

ESSENTIALS OF CHEMICAL PHYSIOLOGY. 8vo., 5s.

* * This is a book suitable for medical students. It treats of the subject in the same way as Prof. SCHAFER'S "Essentials" treats of Histology. It contains a number of elementary and advanced practical lessons, followed in each case by a brief descriptive account of the facts related to the exercises which are intended to be performed by each member of the class.

LANG.—**THE METHODICAL EXAMINATION OF THE EYE.** Being Part I. of a Guide to the Practice of Ophthalmology for Students and Practitioners. By WILLIAM LANG, F.R.C.S. Eng., Surgeon to the Royal London Ophthalmic Hospital, Moorfields, etc. With 15 Illustrations. Crown 8vo., 3s. 6d.

MEDICINE AND SURGERY—Continued.

LIVEING.—HANDBOOK ON DISEASES OF THE SKIN.

With especial reference to Diagnosis and Treatment. By ROBERT LIVEING, M.A. and M.D., Cantab., F.R.C.P. Lond., etc., Physician to the Department for Diseases of the Skin at the Middlesex Hospital, etc. Fcp. 8vo., 5s.

LONGMORE.—Works by Surgeon-General Sir T. LONGMORE C.B., F.R.C.S., late Professor of Military Surgery in the Army Medical School, Officer of the Legion of Honour.

THE ILLUSTRATED OPTICAL MANUAL; OR, HANDBOOK OF INSTRUCTIONS FOR THE GUIDANCE OF SURGEONS IN TESTING QUALITY AND RANGE OF VISION, AND IN DISTINGUISHING AND DEALING WITH OPTICAL DEFECTS IN GENERAL. Illustrated by 74 Drawings and Diagrams by Inspector-General Dr. MACDONALD, R.N., F.R.S., C.B. Fourth Edition. 8vo., 14s.

GUNSHOT INJURIES. Their History, Characteristic Features, Complications, and General Treatment; with Statistics concerning them as they have been met with in Warfare. With 78 Illustrations. 8vo., 31s. 6d.

LUFF.—TEXT-BOOK OF FORENSIC MEDICINE AND TOXICOLOGY. By ARTHUR P. LUFF, M.D., B.Sc. (Lond.), Physician in Charge of Out-Patients and Lecturer on Medical Jurisprudence and Toxicology in St. Mary's Hospital; Examiner in Forensic Medicine in the University of London; External Examiner in Forensic Medicine in the Victoria University; Official Analyst to the Home Office. With 13 full-page Plates (1 in colours) and 33 Illustrations in the Text. 2 vols. Crown 8vo., 24s.

NEWMAN.—ON THE DISEASES OF THE KIDNEY AMENABLE TO SURGICAL TREATMENT. Lectures to Practitioners. By DAVID NEWMAN, M.D., Surgeon to the Western Infirmary Out-Door Department; Pathologist and Lecturer on Pathology at the Glasgow Royal Infirmary; Examiner in Pathology in the University of Glasgow; Vice-President Glasgow Pathological and Clinical Society. 8vo., 8s.

OWEN.—A MANUAL OF ANATOMY FOR SENIOR STUDENTS. By EDMUND OWEN, M.B., F.R.S.C., Senior Surgeon to the Hospital for Sick Children, Great Ormond Street, Surgeon to St. Mary's Hospital, London, and co-Lecturer on Surgery, late Lecturer on Anatomy in its Medical School. With 210 Illustrations. Crown 8vo., 12s. 6d.

POOLE.—COOKERY FOR THE DIABETIC. By W. H. and Mrs. POOLE. With Preface by Dr. PAVY. Fcap. 8vo., 2s. 6d.

QUAIN.—A DICTIONARY OF MEDICINE; Including General Pathology, General Therapeutics, Hygiene, and the Diseases of Women and Children. By Various Writers. Edited by RICHARD QUAIN, Bart., M.D. Lond., LL.D. Edin. (Hon.) F.R.S., Physician Extraordinary to H.M. the Queen, President of the General Medical Council, Member of the Senate of the University of London, etc. Assisted by FREDERICK THOMAS ROBERTS, M.D. Lond., B.Sc., Fellow of the Royal College of Physicians, Fellow of University College, Professor of Materia Medica and Therapeutics, University College, &c.; and J. MITCHELL BRUCE, M.A. Abdn., M.D. Lond., Fellow of the Royal College of Physicians of London, Physician and Lecturer on the Principles and Practice of Medicine, Charing Cross Hospital, &c. New Edition, Revised throughout and Enlarged. 2 Vols. Medium 8vo., 40s. net.

MEDICINE AND SURGERY—Continued.

QUAIN.—QUAIN'S (JONES) ELEMENTS OF ANATOMY.

The Tenth Edition. Edited by EDWARD ALBERT SCHÄFER, F.R.S., Professor of Physiology and Histology in University College, London; and GEORGE DANCER THANE, Professor of Anatomy in University College, London.

* * * The several parts of this work form COMPLETE TEXT-BOOKS OF THEIR RESPECTIVE SUBJECTS.

VOL. I., PART I. EMBRYOLOGY. By E. A. SCHÄFER, F.R.S. With 200 Illustrations. Royal 8vo., 9s.

VOL. I., PART II. GENERAL ANATOMY OR HISTOLOGY. By E. A. SCHÄFER, F.R.S. With 291 Illustrations. Royal 8vo., 12s. 6d.

VOL. II., PART I. OSTEOLOGY. By G. D. THANE. With 168 Illustrations. Royal 8vo., 9s.

VOL. II., PART II. ARTHROLOGY—MYOLOGY—ANGIOLOGY. By G. D. THANE. With 255 Illustrations. Royal 8vo., 18s.

VOL. III., PART I. THE SPINAL CORD AND BRAIN. By E. A. SCHÄFER, F.R.S. With 139 Illustrations. Royal 8vo., 12s. 6d.

VOL. III. PART II. THE NERVES. By G. D. THANE. With 102 Illustrations. Royal 8vo., 9s.

VOL. III., PART III. THE ORGANS OF THE SENSES. By E. A. SCHÄFER, F.R.S. With 178 Illustrations. Royal 8vo., 9s.

VOL. III., PART IV. SPLANCHNOLOGY. By E. A. SCHÄFER, F.R.S., and JOHNSON SYMINGTON, M.D. With 337 Illustrations. Royal 8vo., 16s.

APPENDIX. SUPERFICIAL AND SURGICAL ANATOMY. By Professor G. D. THANE and Professor R. J. GODLEE, M.S. With 29 Illustrations. Royal 8vo., 6s. 6d.

RICHARDSON.—VITA MEDICA: Chapters of Medical Life and Work. By Sir B. W. RICHARDSON, M.A., LL.D., F.R.S. 8vo., 16s.

SCHÄFER.—THE ESSENTIALS OF HISTOLOGY. Descriptive and Practical. For the Use of Students. By E. A. SCHÄFER, F.R.S., Jodrell Professor of Physiology in University College, London; Editor of the Histological Portion of Quain's 'Anatomy'. Illustrated by more than 300 Figures, many of which are new. Fourth Edition, Revised and Enlarged. 8vo., 7s. 6d. (Interleaved, 10s.)

SCHENK.—MANUAL OF BACTERIOLOGY. For Practitioners and Students. With especial reference to Practical Methods. By Dr. S. L. SCHENK, Professor (Extraordinary) in the University of Vienna. Translated from the German, with an Appendix, by W. R. DAWSON, B.A., M.D., Univ. Dub.; late University Travelling Prizeman in Medicine. With 100 Illustrations, some of which are coloured. 8vo., 10s. net.

SMALE AND COLYER. DISEASES AND INJURIES OF THE TEETH, including Pathology and Treatment; a Manual of Practical Dentistry for Students and Practitioners. By MORTON SMALE, M.R.C.S., L.S.A., L.D.S., Dental Surgeon to St. Mary's Hospital, Dean of the School, Dental Hospital of London, etc.; and J. F. COLYER, L.R.C.P., M.R.C.S., L.D.S., Assistant Dental Surgeon to Charing Cross Hospital, and Assistant Dental Surgeon to the Dental Hospital of London. With 334 Illustrations. Large Crown 8vo., 15s.

SMITH (H. E.). THE HANDBOOK FOR MIDWIVES. By HENRY FLY SMITH, B.A., M.B. Oxon., M.R.C.S. Second Edition. With 41 Woodcuts. Crown 8vo., 5s.

MEDICINE AND SURGERY—Continued.

STEVENSON.—WOUNDS IN WAR: the Mechanism of their Production and their Treatment. By Surgeon-Colonel W. F. STEVENSON (Army Medical Staff), A.B., M.B., M.Ch. Dublin University, Professor of Military Surgery, Army Medical School, Netley. With 86 Illustrations. 8vo., 18s.

TAPPEINER. — INTRODUCTION TO CHEMICAL METHODS OF CLINICAL DIAGNOSIS. By Dr. H. TAPPEINER, Professor of Pharmacology and Principal of the Pharmacological Institute of the University of Munich. Translated from the Sixth German Edition by EDMOND J. MCWEENEY, M.A., M.D. (Royal Univ. of Ireland), L.R.C.P.I., etc. Crown 8vo., 3s. 6d.

TIRARD.—DIPHThERIA AND ANTITOXIN. By NESTOR TIRARD, M.D. Lond., Fellow of the Royal College of Physicians; Fellow of King's College, London; Professor of Materia Medica and Therapeutics at King's College; Physician to King's College Hospital; and Senior Physician to the Evelina Hospital for Sick Children. 8vo., 7s. 6d.

WALLER.—Works by AUGUSTUS D. WALLER, M.D., Lecturer on Physiology at St. Mary's Hospital Medical School, London; late External Examiner at the Victorian University.

AN INTRODUCTION TO HUMAN PHYSIOLOGY. Third Edition, Revised. With 314 Illustrations. 8vo., 18s.

LECTURES ON PHYSIOLOGY. First Series. On Animal Electricity. 8vo., 5s. net.

EXERCISES IN PRACTICAL PHYSIOLOGY. Part I. Elementary Physiological Chemistry. By AUGUSTUS D. WALLER and W. LEGGE SYMES. 8vo., 1s. net. Part II. in the press. Part III. Physiology of the Nervous System; Electro-Physiology. 8vo., 2s. 6d. net.

WEICHSELBAUM.—THE ELEMENTS OF PATHOLOGICAL HISTOLOGY, With Special Reference to Practical Methods. By Dr. ANTON WEICHSELBAUM, Professor of Pathology in the University of Vienna. Translated by W. R. DAWSON, M.D. (Dub.), Demonstrator of Pathology in the Royal College of Surgeons, Ireland, late Medical Travelling Prizeman of Dublin University, etc. With 221 Figures, partly in Colours, a Chromo-lithographic Plate, and 7 Photographic Plates. Royal 8vo., 21s. net.

WILKS AND MOXON.—LECTURES ON PATHOLOGICAL ANATOMY. By Sir SAMUEL WILKS, Bart., M.D., F.R.S., President of the Royal College of Physicians, and Physician Extraordinary to H.M. the Queen, and the late WALTER MOXON, M.D., F.R.C.P., Physician to, and some time Lecturer on Pathology at, Guy's Hospital. Third Edition, thoroughly Revised. By Sir SAMUEL WILKS, Bart., M.D., LL.D., F.R.S. 8vo., 18s.

VETERINARY MEDICINE, ETC.

STEEL.—Works by JOHN HENRY STEEL, F.R.C.V.S., F.Z.S., A.V.D., late Professor of Veterinary Science and Principal of Bombay Veterinary College.

A TREATISE ON THE DISEASES OF THE DOG; being a Manual of Canine Pathology. Especially adapted for the use of Veterinary Practitioners and Students. With 88 Illustrations. 8vo., 10s. 6d.

A TREATISE ON THE DISEASES OF THE OX; being a Manual of Bovine Pathology. Especially adapted for the use of Veterinary Practitioners and Students. With 2 Plates and 117 Woodcuts. 8vo., 15s.

VETERINARY MEDICINE, ETC. *Continued.*

STEEL.—Works by JOHN HENRY STEEL, F.R.C.V.S., F.Z.S., A.V.D., late Professor of Veterinary Science and Principal of Bombay Veterinary College—*continued.*

A TREATISE ON THE DISEASES OF THE SHEEP; being a Manual of Ovine Pathology for the use of Veterinary Practitioners and Students. With Coloured Plate and 99 Woodcuts. 8vo., 12s.

OUTLINES OF EQUINE ANATOMY; a Manual for the use of Veterinary Students in the Dissecting Room. Crown 8vo., 7s. 6d.

FITZWYGRAM.—HORSES AND STABLES. By Major-General Sir F. FITZWYGRAM, Bart. With 56 pages of Illustrations. 8vo., 2s. 6d. net.

SCHREINER.—THE ANGORA GOAT (published under the auspices of the South African Angora Goat Breeders' Association), and a Paper on the Ostrich (reprinted from the *Zoologist* for March, 1897). By S. C. CRONWRIGHT SCHREINER. 8vo.

'STONEHENGE.'—THE DOG IN HEALTH AND DISEASE. By 'STONEHENGE'. With 78 Wood Engravings. 8vo., 7s. 6d.

YOUATT.—Works by WILLIAM YOUATT.

THE HORSE. Revised and Enlarged by W. WATSON, M.R.C.V.S. With 52 Wood Engravings. 8vo., 7s. 6d.

THE DOG. Revised and Enlarged. With 33 Wood Engravings. 8vo., 6s.

PHYSIOLOGY, BIOLOGY, BACTERIOLOGY, AND ZOOLOGY.

(And see *MEDICINE AND SURGERY*.)

ASHBY.—NOTES ON PHYSIOLOGY, for the Use of Students Preparing for Examination. By HENRY ASHBY, M.D. With 141 Illustrations. Fcp. 8vo., 5s.

BARNETT.—THE MAKING OF THE BODY: a Children's Book on Anatomy and Physiology, for School and Home Use. By Mrs. S. A. BARNETT. With 113 Illustrations. Crown 8vo., 1s. 9d.

BIDGOOD.—A COURSE OF PRACTICAL ELEMENTARY BIOLOGY. By JOHN BIDGOOD, B.Sc., F.L.S. With 226 Illustrations. Crown 8vo., 4s. 6d.

BRAY.—PHYSIOLOGY AND THE LAWS OF HEALTH, in Easy Lessons for Schools. By Mrs. CHARLES BRAY. Fcp. 8vo., 1s.

CURTIS.—ESSENTIALS OF PRACTICAL BACTERIOLOGY. By HENRY J. CURTIS, M.D. With numerous Illustrations. *In the press.*

FRANKLAND.—MICRO ORGANISMS IN WATER. Together with an Account of the Bacteriological Methods involved in their Investigation. Specially designed for the use of those connected with the Sanitary Aspects of Water Supply. By PERCY FRANKLAND, Ph.D., B.Sc. (Lond.), F.R.S., and Mrs. PERCY FRANKLAND. With 2 Plates and Numerous Diagrams. 8vo., 16s. net.

FURNEAUX.—HUMAN PHYSIOLOGY. By W. FURNEAUX, F.R.G.S. With 218 Illustrations. Crown 8vo., 2s. 6d.

PHYSIOLOGY, BIOLOGY, BACTERIOLOGY, AND ZOOLOGY—Cont.

HUDSON AND GOSSE.—THE ROTIFERA, or 'WHEEL-ANIMACULES'. By C. T. HUDSON, LL.D., and P. H. GOSSE, F.R.S. With 30 Coloured and 4 Uncoloured Plates. In 6 Parts. 4to., 10s. 6d. each Supplement 12s. 6d. Complete in 2 vols., with Supplement, 4to., £4 4s.

LEUMANN.—NOTES ON MICRO-ORGANISMS PATHOGENIC TO MAN. By Surgeon-Captain B. H. S. LEUMANN, M.B., Indian Medical Service. 8vo., 3s.

MACALISTER.—Works by ALEXANDER MACALISTER, M.D., Professor of Comparative Anatomy and Zoology, University of Dublin. With 41 Diagrams.

AN INTRODUCTION TO THE SYSTEMATIC ZOOLOGY AND MORPHOLOGY OF VERTEBRATE ANIMALS. 8vo., 10s. 6d.

ZOOLOGY OF THE INVERTEBRATE ANIMALS. With 59 Diagrams. Fcp. 8vo., 1s. 6d.

ZOOLOGY OF THE VERTEBRATE ANIMALS. With 77 Diagrams. Fcp. 8vo., 1s. 6d.

MORGAN.—ANIMAL BIOLOGY: an Elementary Text-Book. By C. LLOYD MORGAN. With 103 Illustrations. Crown 8vo., 8s. 6d.

SCHENK.—MANUAL OF BACTERIOLOGY, for Practitioners and Students, with Especial Reference to Practical Methods. By Dr. S. L. SCHENK. With 100 Illustrations, some Coloured. 8vo., 10s. net.

THORNTON.—HUMAN PHYSIOLOGY. By JOHN THORNTON, M.A. With 267 Illustrations, some Coloured. Crown 8vo., 6s.

BOTANY.

AITKEN.—ELEMENTARY TEXT-BOOK OF BOTANY. By EDITH AITKEN, late Scholar of Girton College. With 400 Diagrams. Crown 8vo., 4s. 6d.

BENNETT AND MURRAY.—HANDBOOK OF CRYPTOGAMIC BOTANY. By ALFRED W. BENNETT, M.A., B.Sc., F.L.S., Lecturer on Botany at St. Thomas's Hospital; and GEORGE MURRAY, F.L.S., Keeper of Botany, British Museum. With 378 Illustrations. 8vo., 16s.

CROSS AND BEVAN.—CELLULOSE: an Outline of the Chemistry of the Structural Elements of Plants. With Reference to their Natural History and Industrial Uses. By CROSS and BEVAN (C. F. Cross, E. J. Bevan, and C. Beadle). With 14 Plates. Crown 8vo., 12s. net.

CURTIS.—A TEXT-BOOK OF GENERAL BOTANY. By CARLTON C. CURTIS, A.M., Ph.D., Tutor in Botany in Columbia University, U.S.A. With 87 Illustrations. 8vo., 12s. net.

EDMONDS.—Works by HENRY EDMONDS, B.Sc., London.
ELEMENTARY BOTANY, Theoretical and Practical. With 319 Illustrations. Crown 8vo., 2s. 6d.

BOTANY FOR BEGINNERS. With 85 Illustrations. Fcp. 8vo., 1s. 6d.

KITCHENER.—A YEAR'S BOTANY. Adapted to Home and School Use. By FRANCES A. KITCHENER. With 195 Illustrations. Crown 8vo., 5s.

BOTANY—Continued.

LINDLEY AND MOORE.—THE TREASURY OF BOTANY.

Edited by J. LINDLEY, M.D., F.R.S., and T. MOORE, F.L.S. With 20 Steel Plates and numerous Woodcuts. Two parts. Fcp. 8vo., 12s.

McNAB.—CLASS-BOOK OF BOTANY. By W. R. McNAB.

Two Parts.

MORPHOLOGY AND PHYSIOLOGY. With 42 Diagrams.

Fcp. 8vo., 1s. 6d.

CLASSIFICATION OF PLANTS. With 118 Diagrams.

Fcp. 8vo., 1s. 6d.

SORAUER.—A POPULAR TREATISE ON THE PHYSIOLOGY OF PLANTS. For the use of Gardeners, or for Students of Horticulture and of Agriculture. By Dr. PAUL SORAUER. Translated by F. E.

WEISS, B.Sc., F.L.S. With 33 Illustrations. 8vo., 9s. net.

THOMÉ AND BENNETT.—STRUCTURAL AND PHYSIOLOGICAL BOTANY. By OTTO WILHELM THOMÉ and by ALFRED W. BENNETT, M.A., B.Sc., F.L.S. With Coloured Map and 600 Woodcuts.

Fcp. 8vo., 6s.

TUBEUF.—DISEASES OF PLANTS INDUCED BY

CRYPTOGAMIC PARASITES. Introduction to the Study of Pathogenic Fungi, Slime Fungi, Bacteria and Algae. By Dr. KARL FRIEDRICH VON TUBEUF, Privatdozent in the University of Munich. English Edition by WILLIAM G. SMITH, B.Sc., Ph.D., Lecturer on Plant Physiology, University of Edinburgh. With 330 Illustrations. Royal 8vo., 18s. net.

WATTS.—A SCHOOL FLORA. For the use of Elementary

Botanical Classes. By W. MARSHALL WATTS, D.Sc. Lond. Crown 8vo., 2s. 6d.

AGRICULTURE.

ADDYMAN.—AGRICULTURAL ANALYSIS. A Manual of

Quantitative Analysis for Students of Agriculture. By FRANK T. ADDYMAN, B.Sc. (Lond.), F.I.C. With 49 Illustrations. Crown 8vo., 5s. net.

COLEMAN AND ADDYMAN.—PRACTICAL AGRICULTURAL CHEMISTRY. By J. BERNARD COLEMAN, A.R.C.Sc., F.I.C., and

FRANK T. ADDYMAN, B.Sc. (Lond.), F.I.C. With 24 Illustrations. Crown 8vo., 1s. 6d. net.

COOKE.—THE FOUNDATIONS OF SCIENTIFIC AGRICULTURE. By SAMUEL COOKE, A.M., A.M.I.C.E., F.I.C., F.G.S.,

Cor.M.R.H.S., Principal and Professor of Chemistry and Geology, College of Science, Poona. With 85 Illustrations and a Series of Examination Questions. Crown 8vo., 4s. 6d.

WEBB.—Works by HENRY J. WEBB, Ph.D., B.Sc. (Lond.);

late Principal of the Agricultural College, Aspatria.

ELEMENTARY AGRICULTURE. A Text-Book specially

adapted to the requirements of the Science and Art Department, the Junior Examination of the Royal Agricultural Society, and other Elementary Examinations. With 34 Illustrations. Crown 8vo., 2s. 6d.

AGRICULTURE. A Manual for Advanced Science Students.

With 100 Illustrations. Crown 8vo., 7s. 6d. net.

WORKS BY JOHN TYNDALL, D.C.L., LL.D., F.R.S.

FRAGMENTS OF SCIENCE: a Series of Detached Essays, Addresses, and Reviews. 2 vols. Crown 8vo., 16s.

Vol. I.—The Constitution of Nature—Radiation—On Radiant Heat in Relation to the Colour and Chemical Constitution of Bodies—New Chemical Reactions produced by Light—On Dust and Disease—Voyage to Algeria to observe the Eclipse—Niagara—The Parallel Roads of Glen Roy—Alpine Sculpture—Recent Experiments on Fog—Signals—On the Study of Physics—On Crystalline and Slaty Cleavage—On Paramagnetic and Diamagnetic Forces—Physical Basis of Solar Chemistry—Elementary Magnetism—On Force—Contributions to Molecular Physics—Life and Letters of FARADAY—The Copley Medallist of 187c—The Copley Medallist of 1871—Death by Lightning—Science and the Spirits.

Vol. II.—Reflections on Prayer and Natural Law—Miracles and Special Providences—On Prayer as a Form of Physical Energy—Vitality—Matter and Force—Scientific Materialism—An Address to Students—Scientific Use of the Imagination—The Belfast Address—Apology for the Belfast Address—The Rev. JAMES MARTINEAU and the Belfast Address—Fermentation, and its Bearings on Surgery and Medicine—Spontaneous Generation—Science and Man—Professor VIRCHOW and Evolution—The Electric Light.

NEW FRAGMENTS. Crown 8vo., 10s. 6d.

CONTENTS.—The Sabbath—Goethe's 'Farbenlehre'—Atoms, Molecules, and Ether Waves—Count Rumford—Louis Pasteur, his Life and Labours—The Rainbow and its Congeners—Address delivered at the Birkbeck Institution on October 22, 1884—Thomas Young—Life in the Alps—About Common Water—Personal Recollections of Thomas Carlyle—On Unveiling the Statue of Thomas Carlyle—On the Origin, Propagation, and Prevention of Phthisis—Old Alpine Jottings—A Morning on Alp Lusen.

LECTURES ON SOUND. With Frontispiece of Fog-Syren, and 203 other Woodcuts and Diagrams in the Text. Crown 8vo., 10s. 6d.

HEAT, A MODE OF MOTION. With 125 Woodcuts and Diagrams. Crown 8vo., 12s.

LECTURES ON LIGHT DELIVERED IN THE UNITED STATES IN 1872 AND 1873. With Portrait, Lithographic Plate, and 59 Diagrams. Crown 8vo., 5s.

ESSAYS ON THE FLOATING MATTER OF THE AIR IN RELATION TO PUTREFACTION AND INFECTION. With 24 Woodcuts. Crown 8vo., 7s. 6d.

RESEARCHES ON DIAMAGNETISM AND MAGNECRYSTALLIC ACTION; including the Question of Diamagnetic Polarity. Crown 8vo., 12s.

NOTES OF A COURSE OF NINE LECTURES ON LIGHT, delivered at the Royal Institution of Great Britain, 1869. Crown 8vo., 1s. 6d.

NOTES OF A COURSE OF SEVEN LECTURES ON ELECTRICAL PHENOMENA AND THEORIES, delivered at the Royal Institution of Great Britain, 1870. Crown 8vo., 1s. 6d.

LESSONS IN ELECTRICITY AT THE ROYAL INSTITUTION 1875-1876. With 58 Woodcuts and Diagrams. Crown 8vo., 2s. 6d.

THE GLACIERS OF THE ALPS: being a Narrative of Excursions and Ascents. An Account of the Origin and Phenomena of Glaciers, and an Exposition of the Physical Principles to which they are related. With numerous Illustrations. Crown 8vo., 6s. 6d. net.

FARADAY AS A DISCOVERER. Crown 8vo., 3s. 6d.

TEXT-BOOKS OF SCIENCE.

- PHOTOGRAPHY.** By Captain W. DE WIVELESIE ABNEY, C.B., F.R.S. With 105 Illustrations. Fcp. 8vo., 3s. 6d.
- THE STRENGTH OF MATERIAL AND STRUCTURES.** By Sir J. ANDERSON, C.E., etc. With 66 Illustrations. Fcp. 8vo., 3s. 6d.
- RAILWAY APPLIANCES.** By Sir JOHN WOLFE BARRY, K.C.B., F.R.S., M.I.C.E. With 218 Illustrations. Fcp. 8vo., 4s. 6d.
- INTRODUCTION TO THE STUDY OF INORGANIC CHEMISTRY.** By WILLIAM ALLEN MILLER, M.D., LL.D., F.R.S. With 72 Illustrations. 3s. 6d.
- QUANTITATIVE CHEMICAL ANALYSIS.** By T. E. THORPE, F.R.S., Ph.D. With 88 Illustrations. Fcp. 8vo., 4s. 6d.
- QUALITATIVE ANALYSIS AND LABORATORY PRACTICE.** By T. E. THORPE, Ph.D., F.R.S., and M. M. PATTISON MUIR, M.A. and F.R.S.E. With Plate of Spectra and 57 Illustrations. Fcp. 8vo., 3s. 6d.
- INTRODUCTION TO THE STUDY OF CHEMICAL PHILOSOPHY.** By WILLIAM A. TILDEN, D.Sc., London, F.R.S. With 5 Illustrations. With or without Answers to Problems. Fcp. 8vo., 4s. 6d.
- ELEMENTS OF ASTRONOMY.** By Sir R. S. BALL, LL.D., F.R.S. With 130 Illustrations. Fcp. 8vo., 6s. 6d.
- SYSTEMATIC MINERALOGY.** By HILARY BAUERMAN, F.G.S. With 373 Illustrations. Fcp. 8vo., 6s.
- DESCRIPTIVE MINERALOGY.** By HILARY BAUERMAN, F.G.S., etc. With 236 Illustrations. Fcp. 8vo., 6s.
- METALS: THEIR PROPERTIES AND TREATMENT.** By A. K. HUNTINGTON and W. G. McMILLAN. With 122 Illustrations. Fcp. 8vo., 7s. 6d.
- THEORY OF HEAT.** By J. CLERK MAXWELL, M.A., LL.D., Edin., F.R.S.S., L. & E. With 38 Illustrations. Fcp. 8vo., 4s. 6d.
- PRACTICAL PHYSICS.** By R. T. GLAZEBROOK, M.A., F.R.S., and W. N. SHAW, M.A. With 134 Illustrations. Fcp. 8vo., 7s. 6d.
- PRELIMINARY SURVEY AND ESTIMATES.** By THEODORE GRAHAM GRIBBLE, Civil Engineer. Including Elementary Astronomy, Route Surveying, Tacheometry, Curve-ranging, Graphic Mensuration, Estimates, Hydrography and Instruments. With 133 Illustrations. Fcp. 8vo., 7s. 6d.
- ALGEBRA AND TRIGONOMETRY.** By WILLIAM NATHANIEL GRIFFIN, B.D. 3s. 6d. Notes on, with Solutions of the more difficult Questions. Fcp. 8vo., 3s. 6d.
- THE STEAM ENGINE.** By GEORGE C. V. HOLMES, Secretary of the Institution of Naval Architects. With 212 Illustrations. Fcp. 8vo., 6s.
- ELECTRICITY AND MAGNETISM.** By FLEEMING JENKIN, F.R.S.S., L. & E. With 177 Illustrations. Fcp. 8vo., 3s. 6d.
- THE ART OF ELECTRO-METALLURGY.** By G. GORE, LL.D., F.R.S. With 56 Illus. Fcp. 8vo., 6s.
- TELEGRAPHY.** By W. H. PREECE, C.B., F.R.S., M.I.C.E., and Sir J. SIVEWRIGHT, M.A., K.C.M.G. With 255 Illustrations. Fcp. 8vo., 6s.
- PHYSICAL OPTICS.** By R. T. GLAZEBROOK, M.A., F.R.S. With 183 Illustrations. Fcp. 8vo., 6s.
- TECHNICAL ARITHMETIC AND MENSURATION.** By CHARLES W. MERRIEFIELD, F.R.S. 3s. 6d. Key, by the Rev. JOHN HUNTER, M.A. Fcp. 8vo., 3s. 6d.
- THE STUDY OF ROCKS.** By FRANK RUTLEY, F.G.S. With 6 Plates and 88 Illustrations. Fcp. 8vo., 4s. 6d.
- WORKSHOP APPLIANCES,** including Descriptions of some of the Machine Tools used by Engineers. By C. P. B. SHELLEY, M.I.C.E. With 323 Illustrations. Fcp. vo., 5s.
- ELEMENTS OF MACHINE DESIGN.** By W. CAWTHORNE UNWIN, F.R.S., R.Sc., M.I.C.E.
PART I. General Principles, Fastenings and Transmissive Machinery. With 304 Illustrations. 6s.
PART II. Chiefly on Engine Details. With 174 Illustrations. Fcp. 8vo., 4s. 6d.
- STRUCTURAL AND PHYSIOLOGICAL BOTANY.** By OTTO WILHELM THOMÉ, and A. W. BENNETT, M.A., B.Sc., F.L.S. With 600 Illustrations. Fcp. 8vo., 6s.
- PLANE AND SOLID GEOMETRY.** By H. W. WATSON, M.A. Fcp. 8vo., 3s. 6d.

ADVANCED SCIENCE MANUALS.

* * *Written specially to meet the requirements of the ADVANCED STAGE of Science Subjects as laid down in the Syllabus of the Directory of the SCIENCE AND ART DEPARTMENT, SOUTH KENSINGTON.*

BUILDING CONSTRUCTION. By the Author of 'Rivington's Notes on Building Construction'. With 385 Illustrations and an Appendix of Examination Questions. Crown 8vo., 4s. 6d.

THEORETICAL MECHANICS. Solids, including Kinematics, Statics, and Kinetics. By A. THORNTON, M.A., F.R.A.S., With 220 Illustrations, 130 Worked Examples, and over 900 Examples from Examination Papers, etc. Crown 8vo., 4s. 6d.

HEAT. By MARK R. WRIGHT, Hon. Inter. B.Sc. (Lond.). With 136 Illustrations and numerous Examples and Examination Papers. Crown 8vo., 4s. 6d.

LIGHT. By W. J. A. EMTAGE, M.A. With 232 Illustrations. Cr. 8vo., 6s.

MAGNETISM AND ELECTRICITY. By ARTHUR WILLIAM POYSER, M.A. With 317 Illustrations. Crown 8vo., 4s. 6d.

INORGANIC CHEMISTRY, THEORETICAL AND PRACTICAL. A Manual for Students in Advanced Classes of the Science and Art Department. By WILLIAM JAGO, F.C.S., F.I.C. With Plate of Spectra and 78 Woodcuts. Crown 8vo., 4s. 6d.

GEOLOGY: a Manual for Students in Advanced Classes and for General Readers. By CHARLES BIRD, B.A. (Lond.), F.G.S. With over 300 Illustrations, a Geological Map of the British Isles (coloured), and a set of Questions for Examination. Crown 8vo., 7s. 6d.

HUMAN PHYSIOLOGY: a Manual for Students in advanced Classes of the Science and Art Department. By JOHN THORNTON, M.A. With 268 Illustrations, some of which are Coloured, and a set of Questions for Examination. Crown 8vo., 6s.

PHYSIOGRAPHY. By JOHN THORNTON, M.A. With 6 Maps, 203 Illustrations, and Coloured Plate of Spectra. Crown 8vo., 4s. 6d.

AGRICULTURE. By HENRY J. WEBB, Ph.D., B.Sc. With 100 Illustrations. Crown 8vo., 7s. 6d. net.

HYGIENE. By J. LANE NOTTER, M.A., M.D., Professor of Hygiene in the Army Medical School, Netley, Surgeon-Colonel, Army Medical Staff; and R. H. FIRTH, F.R.C.S., Assistant Professor of Hygiene in the Army Medical School, Netley, Surgeon-Major, Army Medical Staff. With 95 Illustrations. Crown 8vo., 3s. 6d.

ELEMENTARY SCIENCE MANUALS.

* * *Written specially to meet the requirements of the ELEMENTARY STAGE OF SCIENCE SUBJECTS as laid down in the Syllabus of the Directory of the SCIENCE AND ART DEPARTMENT.*

PRACTICAL, PLANE, AND SOLID GEOMETRY, including Graphic Arithmetic. By I. H. MORRIS. Fully Illustrated, with Drawings. Crown 8vo., 2s. 6d.

GEOMETRICAL DRAWING FOR ART STUDENTS. Embracing Plane Geometry and its Applications, the Use of Scales, and the Plans and Elevations of Solids, as required for the Examinations for the Science and Art Department. By I. H. MORRIS. Crown 8vo., 1s. 6d.

TEXT-BOOK ON PRACTICAL, SOLID, OR DESCRIPTIVE GEOMETRY. By DAVID ALLAN LOW (Whitworth Scholar). Part I. Crown 8vo., 2s. Part II. Crown 8vo., 3s.

AN INTRODUCTION TO MACHINE DRAWING AND DESIGN. By DAVID ALLAN LOW. With 97 Illustrations. Crown 8vo., 2s.

ELEMENTARY SCIENCE MANUALS—Continued.

- BUILDING CONSTRUCTION.** By EDWARD J. BURRELL. With 308 Illustrations and Working Drawings. Crown 8vo., 2s. 6d.
- AN ELEMENTARY COURSE OF MATHEMATICS.** Containing Arithmetic; Euclid (Book I., with Deductions and Exercises); and Algebra. Crown 8vo., 2s. 6d.
- THEORETICAL MECHANICS.** Including Hydrostatics and Pneumatics. By J. E. TAYLOR, M.A., B.Sc. With numerous Examples and Answers, and 175 Diagrams and Illustrations. Crown 8vo., 2s. 6d.
- THEORETICAL MECHANICS—SOLIDS.** By J. E. TAYLOR, M.A., B.Sc. (Lond.). With 163 Illustrations, 120 Worked Examples, and over 500 Examples from Examination Papers, etc. Crown 8vo., 2s. 6d.
- THEORETICAL MECHANICS—FLUIDS.** By J. E. TAYLOR, M.A., B.Sc. (Lond.). With 122 Illustrations, numerous Worked Examples, and about 500 Examples from Examination Papers, etc. Crown 8vo., 2s. 6d.
- A MANUAL OF MECHANICS.** With 138 Illustrations and Diagrams, and 188 Examples taken from Examination Papers, with Answers. By T. M. GOODEVE, M.A. Crown 8vo., 2s. 6d.
- SOUND, LIGHT, AND HEAT.** By MARK R. WRIGHT. With 160 Diagrams and Illustrations. Crown 8vo., 2s. 6d.
- METALLURGY: an Elementary Text-Book.** By E. L. RHEAD. With 94 Illustrations. Crown 8vo., 3s. 6d.
- PHYSICS.** Alternative Course. By MARK R. WRIGHT. With 242 Illustrations. Crown 8vo., 2s. 6d.
- PROBLEMS AND SOLUTIONS IN ELEMENTARY ELECTRICITY AND MAGNETISM.** By W. SLINGO and A. BROOKER. With 67 Illustrations. Crown 8vo., 2s.
- MAGNETISM AND ELECTRICITY.** By A. W. POYSER, M.A. With 235 Illustrations. Crown 8vo., 2s. 6d.
- ORGANIC CHEMISTRY: the Fatty Compounds.** By R. LLOYD WHITELEY, F.I.C., F.C.S. With 45 Illustrations. Crown 8vo., 3s. 6d.
- INORGANIC CHEMISTRY, THEORETICAL AND PRACTICAL.** By WILLIAM JAGO, F.C.S., F.I.C. With 63 Illustrations and numerous Questions and Exercises. Fcp. 8vo., 2s. 6d.
- AN INTRODUCTION TO PRACTICAL INORGANIC CHEMISTRY.** By WILLIAM JAGO, F.C.S., F.I.C. Crown 8vo., 1s. 6d.
- PRACTICAL CHEMISTRY: the Principles of Qualitative Analysis.** By WILLIAM A. TILDEN, D.Sc. Fcp. 8vo., 1s. 6d.
- ELEMENTARY INORGANIC CHEMISTRY.** By W. S. FURNEAUX, F.R.G.S. Crown 8vo., 2s. 6d.
- ELEMENTARY GEOLOGY.** By CHARLES BIRD, B.A., F.G.S. With Coloured Geological Map of the British Islands, and 247 Illustrations. Crown 8vo., 2s. 6d.
- HUMAN PHYSIOLOGY.** By WILLIAM S. FURNEAUX, F.R.G.S. With 218 Illustrations. Crown 8vo., 2s. 6d.
- A COURSE OF PRACTICAL ELEMENTARY BIOLOGY.** By J. BIDGOOD, B.Sc. With 226 Illustrations. Crown 8vo., 4s. 6d.
- ELEMENTARY BOTANY, THEORETICAL AND PRACTICAL.** By HENRY EDMONDS, B.Sc. With 319 Woodcuts. Crown 8vo., 2s. 6d.
- STEAM.** By WILLIAM RIPPER, Member of the Institution of Mechanical Engineers. With 142 Illustrations. Crown 8vo., 2s. 6d.
- ELEMENTARY PHYSIOGRAPHY.** By J. THORNTON, M.A. With 12 Maps and 247 Illustrations. With Appendix on Astronomical Instruments and Measurements. Crown 8vo., 2s. 6d.
- AGRICULTURE.** By HENRY J. WEBB, Ph.D. With 34 Illustrations. Crown 8vo., 2s. 6d.

THE LONDON SCIENCE CLASS-BOOKS.

Edited by G. CAREY FOSTER, F.R.S., and by Sir PHILIP MAGNUS, B.Sc., B.A.,
of the City and Guilds of London Institute.

ASTRONOMY. By Sir ROBERT STAWELL BALL, LL.D., F.R.S. With 41 Diagrams. Fcp. 8vo., 1s. 6d.

MECHANICS. By Sir ROBERT STAWELL BALL, LL.D., F.R.S. With 89 Diagrams. Fcp. 8vo., 1s. 6d.

THE LAWS OF HEALTH. By W. H. CORFIELD, M.A., M.D., F.R.C.P. With 22 Illustrations. Fcp. 8vo., 1s. 6d.

MOLECULAR PHYSICS AND SOUND. By FREDERICK GUTHRIE, F.R.S. With 91 Diagrams. Fcp. 8vo., 1s. 6d.

GEOMETRY, CONGRUENT FIGURES. By O. HENRICI, Ph.D., F.R.S. With 141 Diagrams. Fcp. 8vo., 1s. 6d.

ZOOLOGY OF THE INVERTEBRATE ANIMALS. By ALEXANDER MACALISTER, M.D. With 59 Diagrams. Fcp. 8vo., 1s. 6d.

ZOOLOGY OF THE VERTEBRATE ANIMALS. By ALEXANDER MACALISTER, M.D. With 77 Diagrams. Fcp. 8vo., 1s. 6d.

HYDROSTATICS AND PNEUMATICS. By Sir PHILIP MAGNUS, B.Sc., B.A. With 79 Diagrams. Fcp. 8vo., 1s. 6d. (To be had also *with Answers*, 2s.) The Worked Solutions of the Problems. 2s.

BOTANY. Outlines of the Classification of Plants. By W. R. McNAB, M.D. With 118 Diagrams. Fcp. 8vo., 1s. 6d.

BOTANY. Outlines of Morphology and Physiology. By W. R. McNAB, M.D. With 42 Diagrams. Fcp. 8vo., 1s. 6d.

THERMODYNAMICS. By RICHARD WORMELL, M.A., D.Sc. With 41 Diagrams. Fcp. 8vo., 1s. 6d.

PRACTICAL ELEMENTARY SCIENCE SERIES.

ELEMENTARY PRACTICAL PHYSIOGRAPHY. (Section I.) By JOHN THORNTON, M.A., Head Master of the Central Higher Grade School, Bolton. With 215 Illustrations and a Coloured Spectrum. Crown 8vo., 2s. 6d.

PRACTICAL DOMESTIC HYGIENE. By J. LANE NOTTER, M.A., M.D., Professor of Hygiene in the Army Medical School, Netley, Surgeon-Colonel, Army Medical Staff; and R. H. FIRTH, F.R.C.S., Assistant Professor of Hygiene in the Army Medical School, Netley, Surgeon-Major Army Medical Staff. With 83 Illustrations. Crown 8vo., 2s. 6d.

ELEMENTARY PRACTICAL CHEMISTRY: a Laboratory Manual for Use in Organised Science Schools. By G. S. NEWTH, F.I.C., F.C.S., Demonstrator in the Royal College of Science, London; Assistant Examiner in Chemistry, Science and Art Department. With 108 Illustrations and 254 Experiments. Crown 8vo., 2s. 6d.

ELEMENTARY PRACTICAL PHYSICS: a Laboratory Manual for Use in Organised Science Schools. By W. WATSON, B.Sc., Demonstrator in Physics in the Royal College of Science, London; Assistant Examiner in Physics, Science and Art Department. With 119 Illustrations and 193 Exercises. Crown 8vo., 2s. 6d.

OTHER VOLUMES IN PREPARATION.

